Koe feliuliuaki ‘o e ‘ea: Ko ha palopalema nai eni?

Understanding climate change in Tonga

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ABSTRACT

Tonga is highly vulnerable to the deleterious impacts of climate change reflecting its geographical, geological and socio-economic characteristics. These impacts have the potential to be a calamity for the environment and the people of Tonga and their livelihoods. Tonga is the first country in the Pacific Islands region to have established a Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management. The primary goal of this plan is to ensure that the communities establish adaptation and mitigation measures to address the impact of climate change. A considerable burden is placed upon the people of Tonga, their knowledge and their understanding of this issue. Literature indicates that the knowledge about climate change should be distributed equally at all levels to enhance effective and successful coping mechanisms for its impacts.

This research was conducted on Tongatapu Island, one of the islands in Tonga that is extremely susceptible to the impacts of climate change. The participants were selected from different locations including coastal villages that are prone to the impacts of climate change as well as less hazard prone areas.

The aim of this research is to unearth the existing knowledge of the people about the issue, their views on the impacts of climate change, and adaptation options they plan to implement in order to reduce the effects of climate change. Understanding of climate change issues varies for a number of reasons. Those who design national policies on climate change may view climate change from a scientific perspective that would be different from how rural villagers might consider the issue.

This research uses the social constructionism approach to identify how this knowledge is constructed and what strategies might be implemented to address the knowledge deficit of the locals.

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HE 'AHO MOE PO KOTOA
KE FAI HO FAKAHIKIHIKI
'I TAIMI MO 'ITANITI.

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This thesis is dedicated to my little family: my husband Peni and our three children; J.J., Penilahi jr and Akosita Vea Manuna Havea jr.

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LIST OF ABBREVIATIONS

ASB	Asian Development Bank
ICH	Intangible Cultural Heritage
INC	Tonga Initial Nation Communication
IPCC	Intergovernmental Panel on Climate Change
JNAP	Joint National Action Plan
MECC	Ministry of Environment and Climate Change
NECC	National Environment Coordinating Committee
NEMO	National Emergency Management Office
PICs	Pacific Island Countries
SNC	Tonga Second National Communication
SIDS	Small Island Developing States
TDS	Tonga Department of Statistics
TWG	Technical Working Group
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nation Framework Convention on Climate Change

CHAPTER ONE: INTRODUCTION

The rapid increase in industrialisation and urbanisation in different countries of the world has caused unfavourable effects to the climate. The enhanced greenhouse gases and its effects is becoming an issue and climate change is becoming a reality. The countries in the Pacific region are susceptible to the adverse impacts of climate change due to their geographical, geological and socio-economic characteristics. Therefore, it is pertinent for the people of the Pacific Island Countries (PICs) to understand the nature of climate change and its risks, and the possible ways to achieve adaptation and mitigation measures to address this issue. Barnett and Campbell (2010) highlight that the Pacific islands are amongst the places where least is known about the ways that climate change will affect them and the ways in which they can adapt to these effects. Since people's understanding of this issue is paramount in regards to the developing coping mechanisms, this research was designed primarily to discover how the people of Tonga understand climate change.

Tonga is one of the PICs vulnerable to the impacts of climate change due to its geographical location, geological composition and socio-economic features. The Kingdom of Tonga has prioritised climate change in its national agenda and it has partnered with the global community to address the detrimental effects of climate change. Tonga ratified the United Nations Framework Convention on Climate Change (UNFCCC) in July 20, 1998 and submitted its First National Communication in 2005 to fulfil its commitment to the UNFCCC (2005). Tonga submitted its Second National Communication (SNC 2012) report in 2012 as a continuation and update of the work done in Tonga's initial report. It's main focus was to reinforce the national capacities, and promote general knowledge and awareness on climate change and natural disasters and their impacts (Ministry of Environment and Climate Change (MECC) 2012).

Tonga is the first country in the region to develop a Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management (JNAP). The Ministry of Environment and Climate Change is the National Executive Agency for climate change activities. (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010).

This research was guided by three research questions:

- What is climate change?
- What are the impacts of climate change in Tonga?
- What is Tonga planning to do to reduce the impacts of climate change?

1.1. Background and setting

1.1.1. Geographical description

Tonga is one of the Polynesian countries. It consists of five main island divisions and many smaller islands. They are scattered in a north-south direction and cover an area of 747 square kilometres and include Tongatapu division (260.48 square kilometres), Vava'u division (121.00 square kilometres), Ha'apai division (109.30 square kilometres), Ongo Niua division, Niuafo'ou and Niuatoputapu, (71. 69 square kilometres) and 'Eua division (87.44 square kilometres) (Tonga Department of Statistics 2013) (See Figure 1)

Tonga is located between 15° and 23° 50" South Latitude and 173° to 177° West Longitude. It has combined land and sea area of 720, 000 km². It consists of 172 named islands with an area of 747 km². There are 35 inhabited islands with an area of 670 km² (Ministry of Environment and Climate Change (MECC) 2005). Tonga are of coralline formation, and they are relatively flat. Tongatapu group for instance is consisted of low islands. There are some islands that originate from volcanic action particularly the west of Ha'apai. Niuafo'ou and Niua Toputapu are high volcanic islands. The south of the Vava'u Group is generally composed of high volcanic and elevated limestone islands and surrounded by fringing reefs. Ha'apai group has high volcanic and low limestone islands (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010).

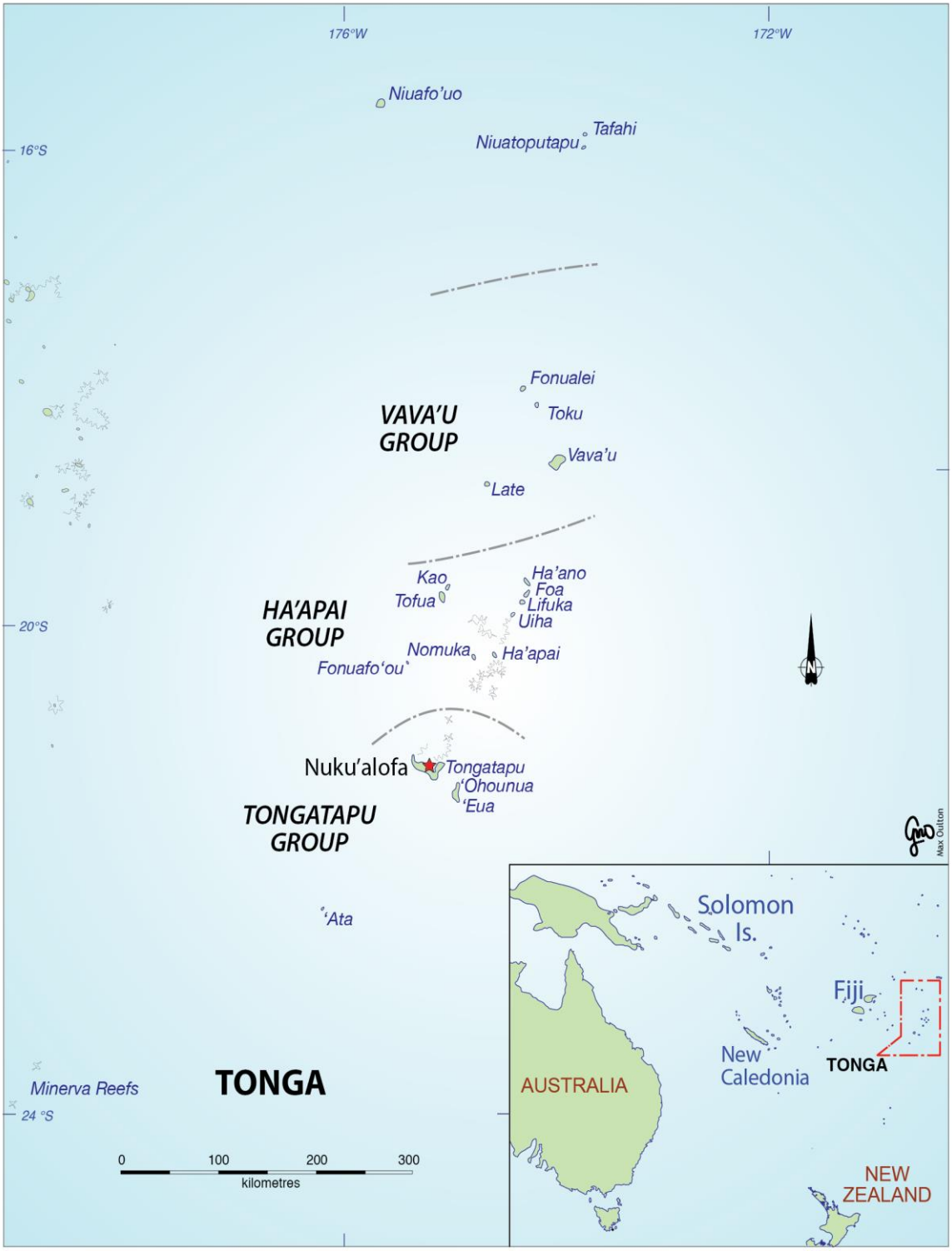

Figure 1. Map of Tonga

(Source: Max Oulton, Cartography unit-Geography Department: University of Waikato)

1.1.2. Population

According to the 2011 census, the total population was 1,032,52 (Tonga Department of Statistics 2013). The majority of the population is located in Tongatapu with a population totalling 75, 158, compared with Vava'u, 14, 936, Ha'apai, 6, 650, 'Eua, 5011 and Ongo Niua, 1, 281 (Tonga Department of Statistics 2013).

1.1.3. Economy

Agriculture has been the key sector of the Tonga economy and also provides the people with food, employment and cash income. Tourism, fisheries and industry are becoming a vital part of the economy as well (Ministry of Environment and Climate Change (MECC) 2012). Tongans utilise both the sea and coastal resources and fertile soils for the provision of their livelihoods. However, coastal development has altered the coastal areas with an increase in the occurrence of coastal and soil erosion. Removing of sand from the beaches for building construction has also contributed to the coastal erosion.

1.1.4. Society and religion

Tongan society has undergone some dramatic changes. This is due to the Late King Tupou IV's vision for a new social class for his country. This was conducted through seeking foreign aid from overseas countries. Tongan families were introduced to the use of concrete and timber for building houses so there were only a few especially in Tongatapu who were still using [1]*Fale Tonga* (Tongan traditional house made of coconut leaves).The adoption of modernisation effected the social status of many people contributed to a better standard of living for many of the people. There are better medical facilities and more education opportunities available for the people of the country (Campbell 1992).

Christianity is the dominant religious belief in Tonga. The Free Wesleyan is the national church with majority of Tongan people are belonging to its congregation. Apart from that, there are other churches such as the Roman Catholics, Latter Day Saints, Free Church of Tonga, *Tokaikolo Fellowship* and *Siasi Tonga Hou'eiki*.

[1] Tongan traditional house

Each family in Tonga belongs to a particular church group. Church obligations such as annual donations known as [2]*misinale*, are carried out to collect money for most church's requirements.

1.1.5. Climate

Tonga has a tropical climate and is notably defined by two seasons; the wet and dry season. The wet season, also known as the hurricane season, is observed from November to April. The dry seasons occurs from May to October. The wettest months are notably January, February and March. Heavy rainfall has been received periodically in Tonga. As a result, flooding in the low lying areas and prolonged pond of water creates diseases such as dengue fever (Ministry of Environment and Climate Change (MECC) 2012).

Tropical cyclones

The trend of cyclone activity around Tonga indicates to be increasing. This is contrast to the South Pacific trend. Figure 2 illustrates the occurrences of tropical on a decadal basis.

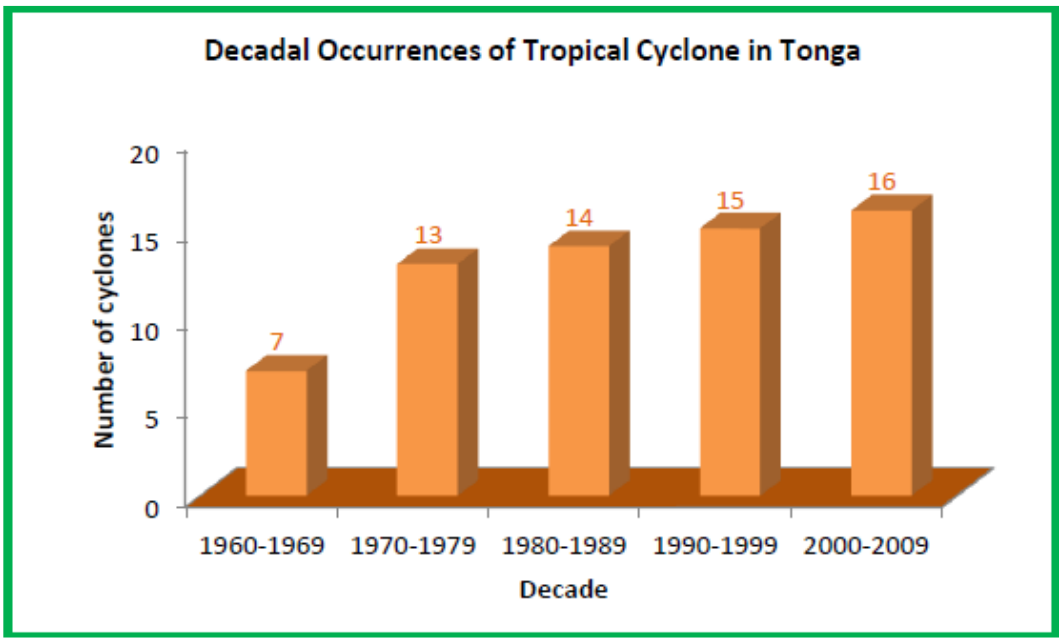

Figure 2. Tropical cyclone trend (MECC and NEMO 2012 83)

[2] Annual missionary donation

This graph shows an increasing trend in the occurrence of tropical cyclones in Tonga.

1.1.6. Drought

Tonga's climate pattern is influenced by the El Niño phenomenon. It refers to the movement of warm sea temperatures from the Western Pacific to the Eastern Pacific. This occurs between three to seven years (Ministry of Environment and Climate Change (MECC) 2012). El Niño events often cause droughts in Tonga. In 1983, 1998 and 2006 droughts were reportedly associated with the May1982-June 1983, May 1997-April 1998 and September 2996-January 2007 El Nino events. These severe droughts affected the revenue earning capacity and livelihoods of the people since their primary source of income is earned from land and sea. The staple subsistence root crops such as cassava, yams and taro are affected too. Thus the food security, customary obligations and the nation's economy are acutely impacted (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010).

1.2. Case study: Tongatapu Island

Tongatapu – 'Sacred South' is the main island of the Kingdom of Tonga and is located in Tonga's southern island group (See Figure 3). It is the location of its capital Nuku'alofa and the centre of its government and the seat of its monarchy. Tongatapu Island is the largest island (approximately 260.5 square km). Tongatapu has a low lying topography with elevation below 2m above sea level in many locations (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010). The southern part of the island has a steep coast and the land steadily drops in elevation towards the north. According to the 2011 census, Tongatapu had a total population of 75, 416 (Tonga Department of Statistics 2013). Tongatapu is subdivided into 7 districts (Ministry of Environment and Climate Change (MECC) 2012). The table 1 shows the 7 districts and their total population.

Table 1. Tongatapu – Population distribution

Districts	Population
Kolofo'ou	18, 957
Kolomotu'a	17, 088
Vaini	12, 949
Tatakamotonga	7, 233
Lapaha	7, 380
Nukunuku	7, 733
Kolovai	4, 076

(Source: Tonga Department of Statistics 2013)

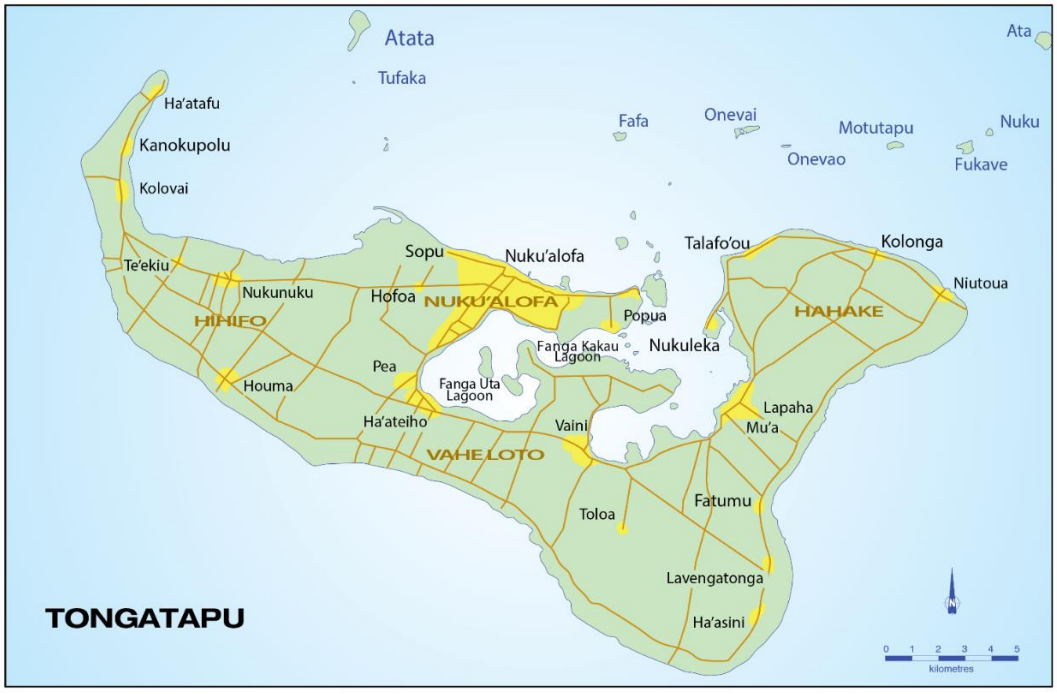

Figure 3. Map of Tongatapu Island

(Source: Max Oulton, Cartography unit-Geography Department: University of Waikato)

1.2.1. Climate trend and sea level trend in Tongatapu

The Tonga Second National Communication (SNC) Project conducted a vulnerability assessment followed the similar methods adopted in its Initial National communication (INC) Project. The assessment was compiled using the following steps:

1. Identification of key sectors vulnerable to climate change impacts

2. Development of historical and observed climatic trends

3. Assessment of historical and current climate change impacts on identified vulnerable sectors

4. Development of future climate change scenarios

5. Assessment of the impacts of geological hazards on sectors

6. Adoption of other practical methodologies

(Source: MECC and NEMO 2012).

The SNC outlines significant data and information regarding observed and future climate and sea level trends in Tonga. The following information illustrates the observed and future climate and sea level trends in Tongatapu.

1.2.2. Temperature trend in Tongatapu

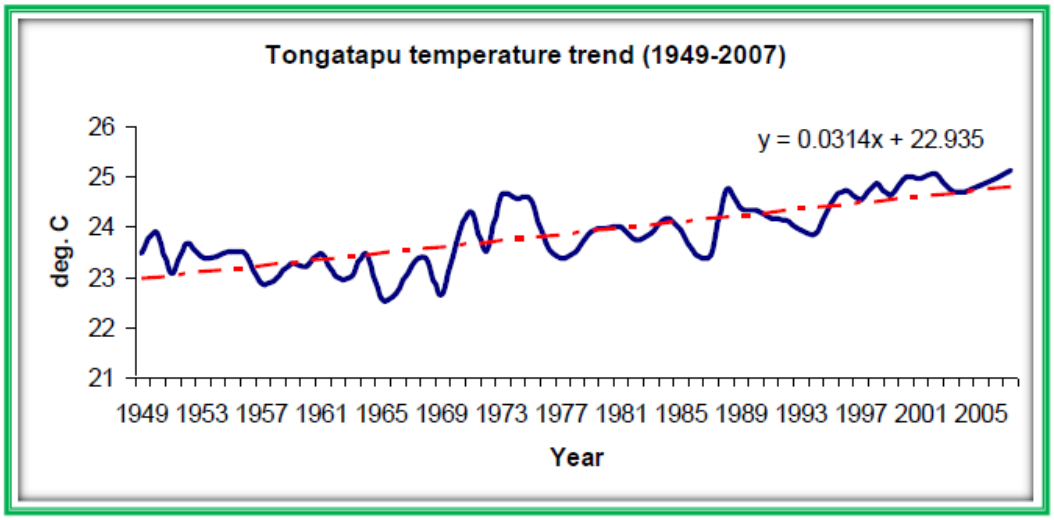

Figure 4. Observed temperature trend for Tongatapu, 1947-2007 (MECC and NEMO 2012 p 79).

Figure 4 indicates a rising of average annual temperature of Tongatapu. The SNC reports shows the temperature rose by 1.8°C from 1949-2007 (Ministry of Environment and Climate Change (MECC) 2012)

1.2.3. Rainfall trend in Tongatapu

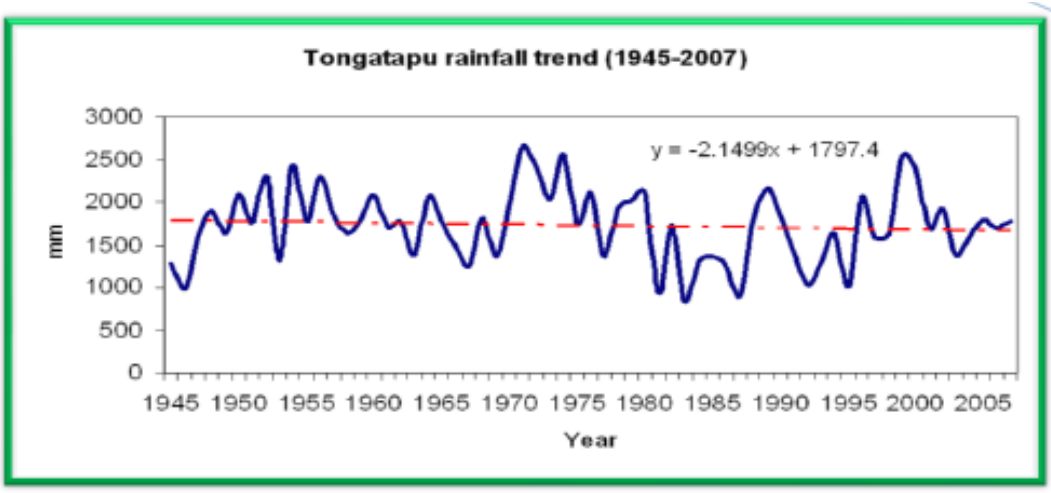

Figure 5. Observed rainfall for Tongatapu, 1945-2007 (MECC and NEMO 2012 75).

Figure 5 shows Tongatapu had several large cycles of rainfall. A long-term wetter periods are shown from early 1950's to 1965, from 1972 to 1982 and from the end

of 1999 to the beginning of 2007 (Ministry of Environment and Climate Change (MECC) 2012)

1.2.4. Drought

Figure 5 also indicates drier period in 1940's. A shorter drier period from 1966 to the 1972 and from mid-1983 to mid-1999, a prolonged dry period are presented.

1.2.5. Sea level trend in Nuku'alofa, Tongatapu

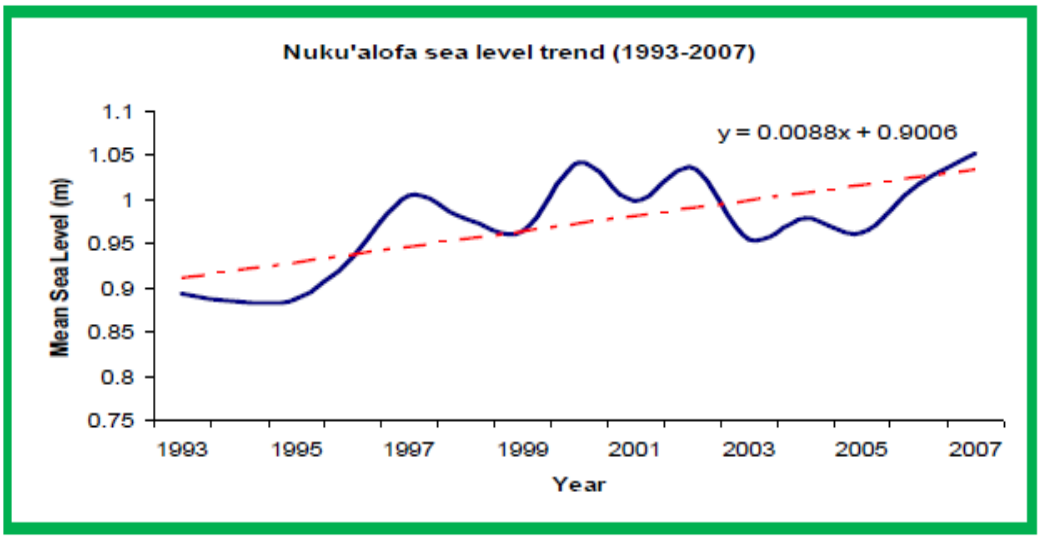

Figure 6. Observed sea level in Nuku'alofa. (MECC and NEMO 2012 80)

Figure 6 illustrates the sea level in Tongatapu was slightly increasing between the 1993 and 2007. Lowlands extend along the north shore is particularly in Nuku'alofa, the capital. "Increases of 0.3 and 1 m in mean sea level (MSL) would cause land loses of 3.1 and 10.3 km , respectively, or 1.1 and 3.9% of the total area of Tongatapu Island. About 2700 and 9000 people would be affected under the 2 scenarios, corresponding to 4.3 and 14.2% of the total population of Tongatapu, respectively" (Ministry of Environment and Climate Change (MECC) 2012 95).

Sea level rise is problematic particularly in low lying coastal areas such as Nuku'alofa, Ha'atafu, Kanokupolu, Nukuleka and Talafo'ou (See Figure 2 for the location of these villages). One of the problems is the reduction in salt water

intrusion which will result in lack of sufficient fresh water for drinking purposes (Ministry of Environment and Climate Change (MECC) 2012).

1.2.6. Inundation in Tongatapu

The settlements and socio-activities in Tongatapu are concentrated on the coastal areas which are highly susceptible to impacts of climate change (See Figure 7). Figure 7 identifies coastal areas and specific villages that have been affected by coastal erosion and inundation. (Ministry of Environment and Climate Change (MECC) 2012).

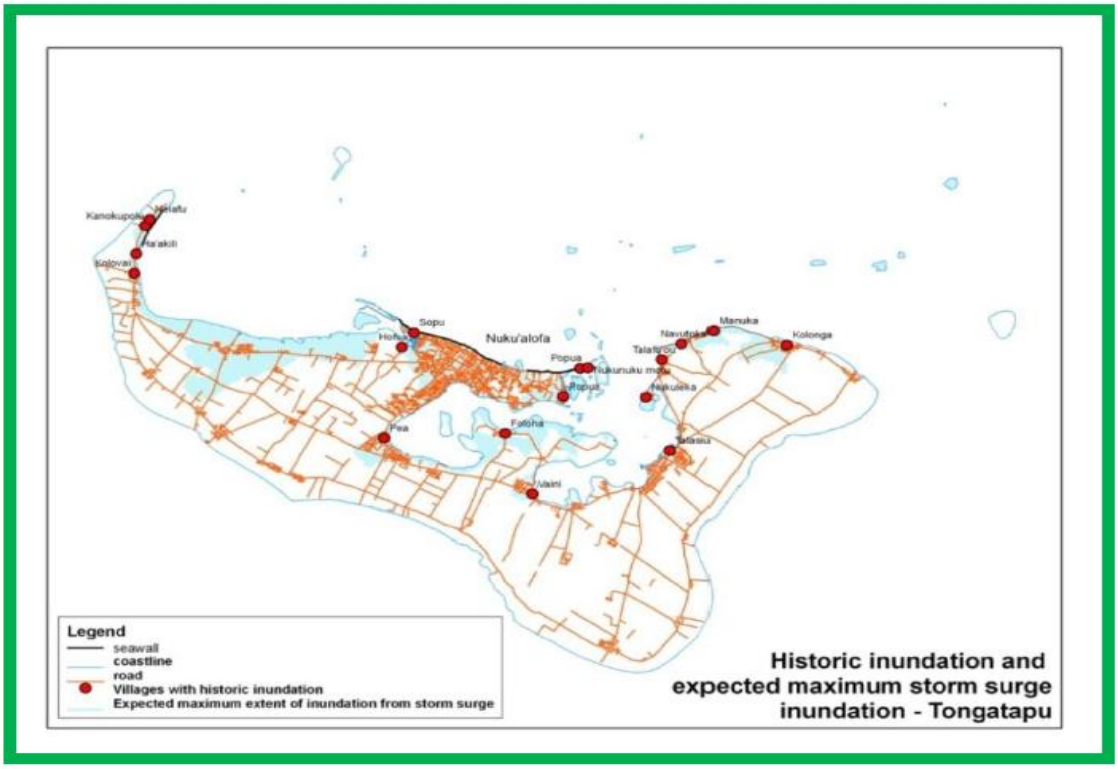

Figure 7. Coastal areas in Tongatapu undergoing inundation and erosion

Source: **(**MECC and NEMO 2012 112).

Table 2. Names and describitions of locations and vulnerable areas along the northern coastaline of Tongatapu that have been exposed to coastal inundation and erosion

AREA	NAMES OF VILLAGES	INUNDATION DETAILS
Hihifo (Western District	Kanokupolu, Neiafu, Haakili, Ha'avakatolo, 'Ahau, Kolovai	Villages are low-lying, less than 2m above mean sea level, inundation occurs on high spring tide up to 100m inland; Most exposed is Kanokupolu where property, tax and town allotments are regularly inundated. Those inundated and eroded areas in Kanokupolu have been rehabilitated (Figure 4.37) except the adjacent communities they still experience with these environmental challenges.
Nukualofa shoreline	Sopu, Hofoa, Popua, Patangata, Nukunukumotu	All low lying areas with large residential populations inundated during spring tides resulting in water pollution and health risks; Half of Nukunukumotu island now inundated on a spring tide (not so 30 years ago) inundating town allotments and half of the registered tax allotments.
Fanga Uta & Fanga Kakau Lagoon	Pea, Folaha and best of Vaini	Loss of town allotments has resulted in reclamation of inter-tidal areas. Loss of mangrove cover due to clearing and harvesting
Hahake (Eastern District)	Nukuleka, Talafoou, Navutoka, Manuka, Kolonga	Villages are low lying less than 1m above high water mark; degraded seawall partly protects the road fronting the villages; At high spring tide, water reaches property landward of the road

(Source: MECC and NEMO 2012 113).

Table 2 shows name of villages of Tongatapu that have been exposed to coastal inundation. Table also illustrate villages where some of my participants live; such as Kanokupolu, Sopu, Popua, Vaini, Kolonga, Nukuleka and Talafo'ou.

1.3. Adaptation

Tonga's Joint National Action Plan 2010 (JNAP) highlights national and community priority goals to ensure the people of Tonga will adapt to the effects of climate change and to mitigate disaster risks. There are six broad goals established to ensure safe, secure and resilient communities to the impacts of climate change and variability. Table 3 lists a number of possible adaptive actions that can be considered in the Tongan context.

Table 3. Adaptation options designed to address the future impacts of climate change in the coastal areas of Tonga

Climatic Parameters	Impacts	Impacted areas	Potential Adaptation options
Sea level rise	*Coastal erosion *loss of coastal vegetation reducing resilience to sea level rise and storm surge *loss of assets and properties *loss of coastal habitat And decreased biodiversity	Low lying coastal communities in Tonga	*Formulate integrated coastal management plan *Install tide gauge & GPS in Ha'apai *climate proof planning, design, decision making on every development on the coast *integrate climate change issues and disaster risks into Environment Impact Assessment Process *Conduct LIDAR survey on coastal erosion of Tongatapu & Ha'apai *Conduct coastal feasibility studies and design of most appropriate measures to vulnerable communities on the coast *Promote coastal reforestation and afforestation *Awareness raising to all levels in Tonga regarding climate change and disaster impacts.
Heavy rainfall	*Flooding inland *Heavy rainfall increases surface runoffs hence contamination of coastal and marine ecosystems	*Low lying areas inland *Soil erosion exacerbates particularly communities with slopy topographic nature hence affecting nearby coastal environment (Tefisi, 'Utulei, Longomapu)	*Proper road drainage to be in place *climate proof all infrastructural development both inland and coastal areas. *Formulate land use policy * Awareness raising to all levels in Tonga regarding climate change and disaster impacts.
Tropical cyclone and storm surge	*Coastal erosion *damage to human settlements and critical infrastructures *loss of assets and properties *damage to coastal vegetation	Low lying coastal areas in Tonga	*climate proof building code *relocation *promote coastal reforestation and afforestation *formulate insurance policy *awareness raising to all levels in Tonga regarding climate change and disaster impacts.

(Source: MECC and NEMO 2012 120).

CHAPTER TWO: LITERATURE REVIEW

There is a wealth of literature regarding public perceptions of climate change indicating a well-established awareness of the issue. Building on this notion, this research explores public understandings of climate change in Tonga. The capacity to develop a substantial knowledge of the issue is crucial, as it may lead to the development of effective adaptation and mitigation options. This literature review is structured into three main sections. The first section will deconstruct climate change in the Pacific, with reference to the effects of climate change on the Pacific Island countries and the responses or the adaptation options that are available to reduce those effects. The second section will explore the framework that guides this research which is social constructionism. The construction of knowledge will also be discussed followed by some reviews of literature that are based around knowledge of nature. The third part of this review will be looking at the social construction of climate change in general and how climate change knowledge is produced and how it gets framed. A wide range of perspectives will be presented in order to address the principle intention of this research which is to discover how the climate change issue is perceived, understood and interpreted by the people of Tonga.

2.1. Climate change and the Pacific Island Countries (PICs)

What is Climate Change?

Climate change has multiple meanings in different contexts. The Intergovernmental Panel on Climate Change (IPCC) defines climate change as "any change in climate over time, whether due to natural variability or as a result of human activity" (IPCC 2001 984). In contrast, the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change to be "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (United Nations 1992 7).

2.1.1. Small Island Developing States (SIDS)

A vast body of literature has proliferated on the images of insularity and smallness of the SIDS. Kempf (2008 195) notes that "...for nowhere have small islands, small land masses, small-island states and microstates been talked of with such frequency, or with such a degree of self-evidence, than in this part of the world." Island communities face unique challenges as anthropogenic influences transform the nature of the global climate. The images of smallness have contributed to placing the small island states at a high level of risk to the impacts of climate change. Their projection indicates that the small island states are at significant risk from the predicted impacts of climate change, particularly sea-level rise (Mimura *et al.* 2007). In addition, Campbell (2014) illustrates the island vulnerabilities when he argues that the islands are environmentally and economically exposed particularly in terms of sea level rise. This notion is supported by Royle (2001 42), arguing that "...small islands are fragile natural systems. Their size and scale make them also problematic in physical terms for human occupation". Hay and Institute of international Global Change (2001) agree by stating that the unfavourable consequences of climate change are already a problem for many small islands people. While the Pacific island people and literatures are debating on the main cause of environmental changes including climate change, Nunn (1997) believes that human activity has been the major cause of environmental impacts.

Barnett and Campbell (2010) seek to present the environmental and social characteristics of Pacific Island Countries (PICs) to better identify their vulnerability to climate change, their smallness, isolation and fragmentation. Kelman and West (2009) claim that the insularity of the island states, the inherent SIDS attributes of isolation, small populations and lack of domestic land-based resources, generate their own environmental and social challenges. The IPCC Assessment Report 5 (AR5, 2014) confirms that the inherent physical characteristics of small islands contribute to the high level of vulnerability of small islands to climate change.

Hau'ofa (2008 52) proclaims the sea as a pertinent facet of the Pacific Island territories which are also known as 'Oceanian societies'. Their culture is a product

of the interaction between the people and the sea. The ocean is regarded as a fundamental part of Pacific people's life. He continued on to clarify on how the Pacific cultures are belittled by the Europeans because of their smallness and according to the images depicted by the Christian missionaries; the Oceania cultures were regarded as "savage and barbaric". Hau'ofa (2008 28) believes the notion of belittlement was born within the Pacific societies. He also observed how the societies of Polynesia were structured according to hierarchical status which he referred to as 'aristocratic societies'. He identified Tonga as an example; whereas the commoners are called [3]*me'a vale* or the 'ignorant ones'. These are the ordinary people and they are ignored while the major important decisions in the society are directed and controlled only by those in the 'aristocracy'.

2.1.2. Impacts of climate change on Pacific Island Countries

> The loss of small island states will affect us all. Climate change refugees will become a serious issue for all countries.
>
> Lord Ma'afu (Pulu 2013 260)

On the 15th December, 2009, a very emotional plea was made by the Tonga's Minister for Environment and Climate Change, Lord Ma'afu, to the international press assembled at the 15th United Nations Climate Change Conference in Copenhagen, Denmark. He wanted to convey his concern about his island, Tonga that he did not want to see it losing to "cyclone and rising sea". While the small islands are struggling with the uncertainty of sea level rise, the people have to deal with the possibility that they will need to look for another place in which to live, (Bedford and Bedford 2010,and Fagan 2013 as cited in Pulu 2013 263). The big questions, however, are raised by Pulu (2013): Where would they go? Who would take them in? What countries would help the Pacific islands?

In 1991, an opening address was made by her Excellency, The Governor General, Dame Catherine Tizard at the conference of the South Pacific environment: interactions with weather and climate; she strongly emphasised that climate change is an issue of interest and concern to most people these days. She

[3] Commoners

highlights that the Pacific island region has become an icon for the impact of climate change. She stated:

> In our region we are particularly conscious of the devastating potential of global warming. We all know that the evidence points to the South Pacific as one of the areas of the world most vulnerable to the impacts of climate change (Hay 1991 1).

Climate change is considered to be one of the most pressing issues for the Pacific Island Countries (PICs). Campbell (2014 3) outlines five impacts of climate change: sea level rise causing coastal degradation including erosion and inundation, declining quantity and quality of water resources, coral reef bleaching, poor agricultural productivity and effects on human health. Its impacts such as changes in cyclones, and sea level rise are " rapidly pushing people beyond their coping range" (Mataki *et al.* 2008 264). The Pacific Islands region is one of the region's most vulnerable to adverse impacts of climate change (IPCC 2007b). This notion is the result of over two decades of assessments and studies that have employed a range of methods and tools to discover the possible impacts of climate change for PICs, the resulting vulnerabilities and the potential adaptation options (Hay and Mimura 2013). However, there are significant uncertainties about its impacts (Shaw *et al.* 2010) which may vary from place to place and leave low lying coastal areas and small islands exposed (Pelling and Uitto 2001). In the Pacific Island region, the impacts of sea level rise differ between low (e.g. atoll) and high (e.g. volcanic) islands. The saltwater contamination of both groundwater and soils make the low islands particularly vulnerable to sea level rise (Asian Development Bank 2010).

These climate change impacts can either be direct or indirect. Direct impacts includes inundation of different locations and infrastructure as a result of sea level rise, and indirect impacts can include changes to market prices of agriculture and fisheries products (IPCC 2007a). Climate change impacts are found to be most extreme at the grassroots-level. Climate change may alter various forms of natural disasters such as droughts, floods and cyclones whereas people's lives and livelihoods are affected. At the same time, the indirect impacts of climate change can be well identified in relation to poverty and health issues (Shaw *et al.* 2010). Pacific Islands' researchers such as John Campbell states that the effects of

climate change may affect island environments as sites of human settlement in three ways: loss of or reduction in "*land security*", "*livelihood security"* particularly food security of island communities and "*habitat security*", and may result in overall declines in community. (Campbell 2014 4-5). In addition, a detailed outline of the impacts of climate change are presented in an ADB report (2010) that states:

> The countries of the Pacific are already experiencing serious disruptive changes consistent with the anticipated consequences of global climate change (Asian Development Bank 2010 4).

Sea level rise boosts the possibilities of sea water intrusion into underground water which is commonly experienced by many coastal communities of the Pacific (ADB, 2010). In Tonga, sea level is recorded to be increasing by 6.4 mm/yr, although this record was only started in 1993 (TMS, Tonga, 2007. Cited in Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010). Coastal erosion is considered a severe issue facing Tonga, and sea level rise is one of the main causes. It affects the underground water supplies and agricultural production particularly in low lying coastal areas throughout Tonga. (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010). The climatic scenarios projected for Tonga are as follows: Increased average temperature; reduced overall rainfall; higher occurrences of heavy rainfall; increased sea level and increased frequency and intensity of tropical cyclones (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010).

A number of reports from different assessments and studies have been prepared to identify potential impacts as they may assist policy makers and other organisations in terms of adaptation options. For instance, the Pacific Islands Climate Change Assistance Programme (PICCAP) assessments revealed that the PICs have experienced pressures posed by climate variability, development and social changes and rapid population growth. Accordingly, the adverse effects arising from these sources of stress on environmental systems would be aggravated by the time the changes in climate change sea level materialise (Hay and Sem 2000). The IPCC Assessment Report 4 (AR4 2007) identifies sea level

rise to dominate vulnerability and impact studies of small island states (As cited in Nurse *et al.* 2014) . The IPCC Assessment Report 5 (AR5, 2014) has affirmed that sea-level rise presents one of the most recognized climate change risks to low-lying coastal areas on islands and atolls (Nurse *et al.* 2014).

2.1.3. Responses and adaptation options available for PICs

Adaptation can be referred to those activities utilised by both individuals and groups of people that allow them to cope with the adverse impacts of climate change (Campbell and de Wet 1999 (b)). The capacity to reduce impacts of climate change is beyond the Pacific Island Countries. The concept of traditional knowledge in the Pacific is evoked by the UNESCO (2013). Adaptation to environment change is part of the Pacific community's lifestyles. Their abilities to successfully live and thrive in the Pacific environment depended on their traditional knowledge, values and practices, or intangible cultural heritage (ICH). In comparing to other scientific knowledge, ICH is more likely to boost the communities' resilience against climate change. The UNESCO (2013) also suggests that culture should be included in the reducing disaster risk and adapting climate change policies, plans and actions. One of the traditional practices used by the Pacific people was the traditional farming systems. They used mechanisms such as use of emergency food resources have allowed Pacific island communities to mitigate effects of "climatological extremes and to ensure food security" UNESCO (2013 12). The Tongan farmers had their own calendar around which farming activities revolved (Kanongata'a, 2011, as cited in UNESCO 2013). In this traditional calendar, the year is made up of thirteen lunar months where each lunar months consists of twenty eight days. The Tongan smallholders utilizes this calendar when they make decisions about planning, harvesting and other farming matters. Traditional support systems in the Pacific island communities are one of the effective mechanisms for resilience: the social cohesion, networks and cooperation. The organisations of events such as traditional feasts and ceremony provided opportunities for cooperation within and among communities and islands. This cooperation is even stronger in times of difficulties, they provided shelters and services for families who were affected (UNESCO 2013).

There are several adaptations that have been implemented in the Pacific islands. These are carried out by various organisations, such as by individuals or national governments and include construction of sea walls to fight coastal erosion among the common steps (Mataki *et al.* 2008). Campbell (2014) highlights how the Pacific island countries have made a very small contribution to the climate change problem but is one of the regions that is adversely mostly affected by climate change.

Treaties and protocols have been formulated to respond to climate change. For instance, the high-level Intergovernmental Panel on Climate Change (IPCC) was established in 1988 (Shaw *et al.* 2010). As stated by Cannon and Müller-Mahn (2010), the warnings of climate change simultaneously have to be followed by an urge for adaptation. In a speech, former UN Secretary Kofi Annan in Nairobi (2006) states:

> The impact of climate change will fall disproportionately on the world's poorest countries, many of them here in Africa. Poor people already live on the frontline of pollution, disaster, and the degradation of resources and land. For them, adaptation is a matter of sheer survival. (Cited in Cannon and Müller-Mahn 2010 626)

Applying this understanding to the Pacific Island nations, Hay and Mimura (2010) specifically point out that a smart effort is required at all levels to address climate change as its risks are increasing in the Pacific. However, despite the efforts that have been put forth by various planning and assessment bodies (Nunn 2009), the PICs have not yet received substantial reductions in the climate related risks and vulnerabilities that they encounter (Barnett and Campbell 2010).

As mentioned in the previous chapters, (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010), Tonga is the first country in the Pacific region to establish a Joint National Action Plan (JNAP) on Climate Change Adaptation and Disaster Risk Management. This plan is made up of six priority goals.

The JNAP and Disaster Risk Management Plan is made up of six priority goals.

1. Improved good governance for climate change adaptation and disaster risk management (mainstreaming, decision making, organizational and institutional policy frameworks)
2. Enhanced technical knowledge base, information, education and understanding of climage change adaptation and effective disaster risk management.
3. Analysis and assessments of vulnerability to climate change impacts and disaster risks.
4. Enhanced community preparedness and resilience to impacts of all disasters.
5. Technically reliable, economically affordable and environmentally sound energy to support the sustainable development of the Kingdom.
6. Strong partnerships, cooperation and collaboration within government agencies and with Civil Societies, Non Government Organisations and the Private Sectors.

(Source: Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010 40-42)

2.1.4. Top-down approach

Lord Tu'ivakano of Tonga states that that there is a political desire for the state and the government to promote good working relationships with communities to ensure climate adaptation is happening in Tonga. He stresses the point that the government's budget is dependent on aid donations. These are not done-deal agreements as the final decision has to be made by those who give the money, not the developing country recipient (Pulu 2013). One of the main downfalls of adaptation in Tonga is that the Government fails to provide financial support the climate projects that the village communities require. Adaptation in small islands is often regarded as illusive where people in the villages view funding as an out-of-reach process and as a result they are left suffering on the bottom level (Pulu, 2013). It has been broadcast in Tonga that the government has failed to integrate community development in its policies (Television Tonga News 2013). The top down approach is explained by Mataki et al. (2008), as crucial to every national

adaptation policy to promote and assist adaptations that help to make the society more climate-proof. He emphasizes that the national level actions should develop and improve regulation of climate sectors and geographic areas and create incentives for adaptation by local authorities (Mataki *et al.* 2008)

2.1.5. The bottom up approach

The bottom up approach refers to community based activities that involve local stakeholders to examine and prioritize risks, search for suitable responses, and implement selected measures using local institutions, resources and knowledge. Individuals and local institutions may require proper support and incentives from the government. This approach underpins aspects of cultural and communal based traditions of Pacific islands and societies (Mataki *et al.* 2008). Therefore, adaptation processes in the Pacific island countries are unique due to the fact that the strong communal nature of living and working together, may enhance resource mobilizations such as finance and local expertise that are required for adaptation. Adaptation should be taken within the context of the community as a whole. Kelman (2007) supports the aspect of tight kinship networks, unique heritage and local knowledge to be important for dealing with environmental changes including climate change.

A very interesting aspect of adaptation in the Pacific is discussed by Barnett and Campbell (2010 178). In order for adaptation to be successful, discussions should be designed at the level of the villages. They highlight that the goal and all aspects of adaption measures can only be understood ‘in terms of social context in which adaptation takes place; communities value things differently and these must be taken into account if adaptation is to be effective, efficient, legitimate and equitable’.

Since Pacific islanders have been dealing with a changing environment for centuries, adaptations to change have become a part of the lifestyles of the Pacific communities and traditional knowledge, values and practices strengthen the ability of communities to successfully live in the Pacific environment (UNESCO 2013). The deputy of the Tongan Democratic Party, Sitiveni Halapua, clarifies how indigenous knowledge can be well integrated to climate adaptation. In a

conference at the University of Hawaii where he reflected on how he used to learn things when still a small boy such as how to harvest food and to preserve some in case there is a drought. He stresses that this knowledge is gone (Halapua 2012). This is highlighted by Kelman and Khan (2013), who state that many island people employ their indigenous, local and or traditional knowledge to provide them with effective ways in dealing with hazards such as climate change. Nakalevu (2006) focuses on providing methods for local communities in the Pacific region to be involved in analysing their own situations and in making decisions regarding climate change by using both their own knowledge and top-down approaches. Shaw *et al.* (2010) argue that although some island communities are well equipped with traditional knowledge and wisdom, there are new practices and policies that are required for these people to establish sufficient coping strategies to deal with climate change.

There are also challenges encountered by every community in terms of adaptation. Mataki *et al.* (2008 273) highlight four main weaknesses the Pacific islands are facing. They are: perceptions and competing governmental and individual priorities, weak governance and institutional frameworks, weak socioeconomic conditions and lack of technical capacity. Despite all of these weaknesses, Tonga in its Joint National Plan, has designed a set of adaptation options to address the impacts of climate change such as replanting coastal vegetation, constructing sea walls and increasing of fresh water harvesting (Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO) 2010). Hau'ofa (2008 27) stresses the importance of studying grassroots activities that are often overlooked and misinterpreted by the "academic and consultancy experts".

Having discussed the Pacific island people and how they utilise their knowledge and skills to cope with the consequences of climate change, the next section is a discussion on the theoretical approach that guides this research which is social constructionism.

2.2. Social constructionism

This thesis aims to discover how the people of Tonga understand climate change, and to explore knowledges that underlie this issue. What appears to be crucial in this research is the fact that there are factors contributing to the construction of these knowledge. This research sought to use social constructionism to explore how climate change knowledge is being constructed by the people of Tonga. As social constructionism insists, " we take a critical stance toward our taken for granted ways of understanding the world, and would not accept that knowledge comes from objective unbiased observations, personal construct theory would reject the notion of an objective reality" (cited in Wilson and Tagg 2010 72). The term social constructionism has stirred a global debate, as there is no single definition can that suitably encapsulate its meaning. Some writers may share some characteristics with others, however, "there's not really anything that they all have in common" (Burr 1995 2). Social constructionism is also of interest to researchers who require to examine whether "knowledge is simply a social product or whether it's based on objective truths not affected by the social world." (O'Leary 2007 1).

What is social constructionism?

Barnes (2009), in The *Dictionary of Human Geography* (Gregory *et al.* 2009 690), defines social construction as "the idea that social context of individuals and groups constructs the reality that they know, rather than the independent world." He continues on to argue that knowledge is correlative to the social milieu of the inquirer, the outcome of an ongoing and dynamic process of fabrication. Social construction is also applied to forms of specialised understanding "as it does to everyday, taken-for-granted knowledge." (Barnes 2009 690). Burr (2003) concurs with Barnes that social constructionism requires us to carefully examine the ways of understanding the world, including ourselves. She strongly believes that the ways in which we understand the world and the concepts that we use, are historically and culturally specific. We do not find meaning but we make it and the meaning we make is affected by our social interpretation of the thing (Burr, 2003). Lock and Strong (2010 2) declare that this is a changing world; lives and perceptions are simultaneously changing over time. They believe these changes

emerge as a result of "…the differing ways that meanings are constructed and reconstructed through peoples' histories in interacting with each other: how people experience the world and make sense of it is primarily the product of social-cultural processes." It reveals that the whole processes have their human roots in history rather than biology.

The original meaning of social construction was provided in 1966 by two American sociologists, Peter Berger and Thomas Luckman. Their interests are based on how ordinary people come to define reality in their everyday life and how they obtain and use knowledge to manage their behaviour. "The world of everyday life is not only taken for granted as reality by the ordinary members of society in the subjectively meaningful conduct of their lives. It is a world that originates in their thoughts and actions" (Berger and Luckmann 1967 33). People interact and communicate with each other in everyday and this "ongoing correspondence" between their meanings enables them to share a common sense about its reality (Berger and Luckmann 1967 37).

Rippl (2002) supports this notion by looking at how the environmental or social issues are socially and culturally framed. She states that the values and worldviews of certain social or cultural contexts can shape individual's understanding and perception. Douglas and Wildavsky (1982) continue to stress that individuals are already embedded in a social structure and therefore the social context of individuals frames their values, attitudes, and worldviews.

Although most of the theorists believe that events and social phenomena have an independent and objective existence, the social constructivists argue that people actually create social phenomena and they become real in our world.

2.2.1. Social construction of knowledge

What constitutes knowledge varies in different contexts and cultures. This research is informed by Castree's (2005) definition of knowledge, which positions people as producers and consumers of knowledge. He suggests knowledge refers to any form of understanding that can be enunciated verbally, textually or pictorially. Similarly, knowledge is how the world is presented by oneself to others. Knowledge is obtained through observation, interaction with others and

interrelating with the material world. There are various debates about how knowledge is constructed but I will focus my discussion only on how knowledge is socially constructed. Adopting the idea of Barnes (2009), knowledge relates to the social setting of the inquirers and the outcome of an ongoing dynamic process of fabrication.

Berger and Luckmann (1967 15) state that all human 'knowledge' is developed, transmitted and maintained in social situations. In everyday life, knowledge is socially distributed and possessed differently by different individuals. (Berger and Luckman, 1967).

Burr (2003) presents the social construction of knowledge differently. She argues that knowledge is seen not as something that a person has or does not have, but as something that people do together. She also states that our knowledge of the world and our common ways of understanding are not caused by nature, but co-constructed among people. It is the daily interactions of people and their individual ways of life that weave our version of knowledge.

2.3. Knowledge of nature

The social construction of knowledge effects how nature comes to be known and understood. There have been debates about whether nature is socially constructed or not. Tanskanen (2009) views nature as a concept which is ambiguous, complex, promiscuous, but also familiar. He refers to nature as the aspects of the physical world and also life in general. He argues that:

> …nature is external, nonhuman reality, somehow pure and God given but, on the other hand, It is an abstraction that incorporates human, as well as non-human spheres of reality (Tanskanen 2009 293).

In contrast, Smith and O'Keefe (1980) argue that

> nature is more abstract, incorporating human as well as non-human spheres of reality" (Smith and O'Keefe 1980 30).

Smith and O'Keefe (1980) note that social science studies see nature as socially constructed. Some human geographers also advocate that nature is socially

constructed. This notion illustrates that all knowledge of nature is "contextual and socially constituted and people can understand nature only through their own culturally constructed definitions of it" (Tanskanen, 2009 294).

Knowledge is believed to be able to shape how we understand things. (Castree 2005) concurs with this by saying that knowledge of nature have multiple origins, meanings, referents and audiences. Hence, knowledge of nature shapes understandings of, attitudes towards and practices upon things we consider as natural.

2.3.1. Christianity's views of their relation with environment?

While a collection of mythologies provide stories regarding the creation of the earth, Christians derived their belief that God had created the earth from Judaism. God is considered by Christians as loving and powerful and who created "light and darkness, the heavenly bodies, the earth and all its plants, animals, birds, and fishes. Finally, God had created Adam and, as an afterthought, Eve to keep man from being lonely" (White 1967 1206). Nature was a created to symbolise an exceptional communication between God and men and (White 1967 1206) agrees by stating that it was a 'symbolic system through which God speaks to men..". A very striking point highlighted by White (1967) is that the creation of the earth was primarily for man's benefits and that man was made in God's image.

Viewed from an ecological anthropology perspective, the feelings, traditions and religious values that affect human societies, including how they interact with their environment, how environments are regarded and treated and how their health may be maintained are important in understanding how nature comes to be known (Ray 2002). This perspective assists us to see how people perceive, understand and respond to climate change as well as enabling us to design effective strategies for changing behaviours, subsistence techniques and natural resource consumption practices to reduce vulnerability to global warming. Ray argues that we have disturbed our environments and they have altered us. He also claims that human have exploited the landscapes to suit their cultural frames for beauty (Ray 2002). Ellen (1982) supports this by stating that only a few environments are not

yet altered by humans and all landscapes are already culturally modified to some degree.

2.3.2. Pacific views: Tongan perspectives on nature

> we are part of Nature, …we are at one with Nature, and … in Nature we find our roots (Mahina 1993 113)

Segments of myths will be discussed to convey viewpoints of nature, but this review is primarily focused on Dr Okusi Mahina's viewpoints of nature. Mahina recounts the era when the island has been landed on by new arrivals. They had to:

> "...acquire knowledge of their land and sea surroundings, so that these could be exploited for basic livelihood, out of which was born an ecology-centred concept of human existence. To know one's environment is to be at one with it, whether in terms of when to cultivate or harvest specific crops, catch certain fish, or set sail to a particular island. Through experience [4](*taukei*), such knowledge [5]*('ilo*) and skills [6](*poto*) are acquired by observation of the systematic behaviour or natural phenomena such as the sun, moon, stars and changing tides, and are perfected from generation to generation" (Mahina 1993 118)

According to Mahina, some "aspects of the society are naturalised through ideological conditioning, Nature in this anthropo-ecological context is humanised" (1993 109). When the landscape is believed to have connections between specific places, it literally refers to social, emotional, economic and political relationships between groups in society which are linked in with the environment. One of the Tongan literary genres is known as [7]*laumatanga.* This refers to "enumerating-beautiful spots: [8]*matanga* is a cognate of [9]*mamata'anga*, a (beautiful place to look at, pride in locality, in Tongan Nature poetry" (Mahina 1993 112).

It is also significant to take a look at how knowledge of nature is being produced. There are multiple disciplines and a whole combination of academic subjects that

[4] Experienced
[5] Knowledge
[6] Skills
[7] One form of reciting Tongan historical and beautiful spots
[8] Historical sites or beautiful spots
[9] Special site for sightseeing

produce knowledge of nature. Castree (2005) argues that academic disciplines are only ones of numerous realms where knowledge of nature are produced. These include newspapers, movies, television programmes, popular books, governments, businesses, courts and charities. In addition, there are broadcasters, pundits, freelance writers and environmental activists who occasionally include nature in their discussions. These bodies of knowledge producers deliver a continuous number of perspectives about nature and appropriate ways to use it, control it or alter it (Castree, 2005). A myriad of sources of knowledge of nature are constantly circulated on daily basis, and as individuals, we have access to numerous nature-knowledges. Our perceptions and understandings of nature are therefore strongly influenced by what is being displayed by the knowledge producers we encounter (Castree, 2005).

2.4. Social construction of climate change

The greenhouse effect first became an object of public awareness in the Western world in the late 1980's. As result of this, "a variety of powerful political interests served as mid wives to the birth in the mid to late 1980's of climate change as a pressing global environmental problem" (Demeritt 2001 307). An expanding climate science community has defined anthropogenic climate change as a global problem caused by human fossil fuel burning, deforestation and elevated levels of greenhouse gases in the atmosphere (Bäckstrand and Lövbrand 2006). Barnett and Campbell (2010) state that scientific interest in climate change began throughout the 1970's and 1980's and they state that "media interest was also increasing and the foundations for a global climate regime were being developed through a series of high-level meetings" (p. 52). They proceed to name several meetings conducted primarily to address the issue of climate change but regarded the Intergovernmental Panel on Climate Change (IPCC) as the "most prominent of the international scientific institutions that are associated with research on climate change" (Barnett and Campbell 2010 53). Hulme (2013) made this explicit by discussing how the publication of the first assessment of the intergovernmental Panel on climate change (IPCC) in 1990 aided the governments to provide a knowledge base for guiding negotiations towards a multi-lateral global agreement on climate change. This was capped when the United Nation Framework

Convention on Climate Change (UNFCCC) was signed by almost all countries at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro (Paterson, 1996) and ratified two years later. In 1996, the IPCC's second assessment report was published and following UNFCCC negotiating process resulted in the Kyoto Protocol being signed in 1997 (Hulme 2013). The Kyoto Protocol "adopted a targets-and-timetables approach to mitigation, whereby signatory nations agreed to reduce their emissions of greenhouse gases by specified amounts from a 1990 baseline by the period 2008-2012" (Hulme 2013 3).

(Demeritt 2001 307) states that global warming has been shifted from an "obscure technical concern into a subject of widespread public anxiety and international regulatory interest". Drawing upon this notion, to explore how climate change is recognised, conceptualised, understood and constructed by different contexts is fundamental as it may bring to light the hidden meaning lost in the climate change arena (Pettenger 2007). There is a vast body of literature exploring how climate change is constructed but the focus of this thesis emphasizes how climate change is socially constructed. However, there are no restrictions as some aspects of scientific and cultural construction of climate change will also be addressed as the discussion progresses. While still debating whether climate change is socially constructed or not, Cannon and Müller-Mahn (2010) argue that since global warming is being caused by human action, then these are socially constructed problems.

Pettenger (2007) sought to uncover the dialogue between power and knowledge found in the social construction of climate change. Peter Haas (2004), agrees with this notion and explores how epistemic communities may contribute in producing knowledge, gaining power and affecting political processes. Haas (2004) also discusses the dialogue between power and knowledge in which the social understandings of climate change have been socially constructed. The work of his paper is closely linked to Pettenger's work, seeking to understand the interpretations of climate change "vis-á-vis the social processes of climate change conceptualization, i.e., what it is and how its causes and consequences, and the planned responses to it, are constructed" (Pettenger 2007 2). This thesis adopts

Pettenger's (2007 3) definitive assumption that "climate change must be understood from the context of social settings.". She also highlights that the policymakers and academics often ignore the importance of how knowledge and power structures are generated.

Pettenger (2007) examines how climate change should be interpreted and understood differently by different people. She elaborates on this by saying that asking ten people to define climate change, its causes and its effects, will yield ten different answers. A fundamental point is also established in regards to how the language used to discuss and describe climate change is "value-laden as the terms employed have different meanings depending on who is discussing the topic and why. What is clear is that the meaning of climate change is defined in social settings" (Pettenger 2007 5).

2.5. The production of climate change knowledge

It is believed that the politics of climate change is progressing into a new era. Climate governance has been allied with a science-based monitoring of the global climate system and a multilateral climate regime negotiated under the United Nations' jurisdiction (Bäckstrand and Lövbrand 2006). There is already a vast body of literature generated by debates together with numerous narratives over whether climate change is a natural phenomenon or a human induced activity. Although this notion is fundamental, the focal interest of this review is intended to bring to light the production of climate change knowledge, to examine who produces this knowledge, how it is presented and why these bodies of knowledge are significant.

2.5.1. How climate change gets framed – Understanding the science of climate change

Climate change can be framed in multiple ways, "as a security issue, as a threat to economic well-being, as a question of social justice. The most common framing is still the original frame, namely climate change is an environmental problem"(Hulme 2007 243). Querying whether climate change is a notion that is invented and people talk about or a physical phenomenon that we have detect and assess, (Hulme 2013) argues that it is a hybrid character; it exists both in our

social discourse and in an external physical reality. It is moved from being a predominantly physical phenomenon to being a social one, in light of reshaping and influencing the way we think about ourselves and our societies. The idea of climate change is unavoidable. It has become a significant point of debate in various disciplines, the worlds of domestic politics and international diplomacy, law, academia, development, welfare, religion, ethics, art and celebrity. Therefore, these fields will impart different meanings about climate change and will generate different procedures of action (Hulme, 2013).

(McCarthy 1996 27) states that each individual has developed powers of observation and reason, and each individual has an absolute right to participate in the process of governance. As scientific communities have grown strong, so they have "developed specialized vocabularies, methodologies, forms of analysis and practices of reason." Therefore, any opinions that are not based on these standards of the knowledge class- for example, on personal values, spiritual insights, commitments to another tradition- are often disregarded. Hume (2007 243) argues that science is a "means of inquiry into how the world works has been successful because it has developed a series of principles, methods and techniques for revealing physical cause and effect within the observable universe". In terms of climate change, science has been working hard to establish knowledge about the increasing concentration of greenhouse gases in the atmosphere and how it warms the planet. Hulme (2007) believes that people have come to know more about climate change since the Intergovernmental Panel on Climate Change scientific assessments have been published. Although science operates well in divulging issues such as environmental problems, one of its limitations is that science lacks the "goals of public policy or for motivating individual or collective changes in behaviour to secure such goals…this limitation is acute in the case of climate change" (Hulme, 2007 243)

Hulme (2013), states that the Intergovernmental Panel on Climate Change (IPCC) has constructed a forceful scientific consensus about the physical transformation of the world's climate. The inauguration of the Kyoto Protocol enabled climate change to be widely recognised by the international community (IPCC, 2001, 2007). Hulme (2013) positively stresses the fact that some actors are framing

climate change only as a matter of science, technology and economics and fail to engage with the social and cultural dynamics by which climate change gains its public meaning and cultural significance. Therefore, he strongly argues that it is essential for scientists, citizens, campaigners and politicians of climate change to be aware of the ways how climate change is being framed by different actors in public settings.

Various literatures contain arguments about whether science is socially constructed or not. Some literatures is exploring how deficient science is. Demeritt (1996 484) believes that although science performed remarkably well in some levels, it has also constructed numerous "environmental spectres that make the future of that of life seem so insecure". He stresses that in the sphere of global environmental changes where science may be regarded as more paramount than ever, many people disregard science as "pure fiction". He states that science is "merely social construction and the nature it studies an artefact of the way that it is represented to be". Basically, from his perspective, science is regarded as similar to other kinds of knowledge, it is made up. Gergen (1985) addresses the limitations of science by examining how it takes over other knowledges such as traditional and spiritual values. He perceives science as "truth beyond tradition, beyond value, beyond question", therefore, affecting people's ways of life. Gergen believes that science is socially constructed. Citing Mannheim *et al.* (1936), Gergen justifies that scientific theories do not exist from observation but from the scientist's social group and these scientific groups are allocated around some certain theories. Therefore, the assumption is that scientific knowledge is an end result of a social process (Gergen 1985).

Lowe et al. (2006) complement this view by arguing that the representations of climate change such as in media have an effect on how the public perceive climate change because it can possibly bring about or encourage behavioural modification. They also stress the point that source of information is one factor that can influence public's understanding. They argue that who is giving the information is significant to the public (Lowe *et al.* 2006). Māhina (1993), extend on this by saying that relevant or trusted messengers can boost the communication of climate change particularly to lay audiences. For instance, pioneering industry

leaders may appear well founded to industry audiences while moral argument in terms of climate change will be more acceptable if provided by religious leaders. However, delivering the information of climate change to the public is challenging indeed as (Bostrom *et al.* 1994) state that in order to educate the public, it is essential to identify what they already know and believe and how it differs from what they need to know in order to make effective decisions.

2.5.2. Media coverage of climate change

Mass media is an essential source of information from which the general public gains most of its knowledge about science (Nelkin 1987). This indicates how the media plays an important role in the public's awareness and perception of climate change issues. Wahlberg and Sjoberg (2000) and Weingart and Pansegrau (2003) discuss how television, radio and newspapers were used to disseminate complicated issues of science, technology and politics to the public; already reached a critical point as the media have become extremely dominant and distinctly powerful.

In terms of images and words used to address the issue of climate change, Bostrom (2003) advised, they should be effective enough to grab the public's attention and not be overtaken by other effective day-to-day issue. Lowe at al. (2006) also state that although the information on climate change is delivered through various sources and can improve public awareness of climate change, it is also difficult to comprehend the causes and effects of climate change and the ways in which people may be directly affected and how to tackle the effects.

2.5.3. What hinders the public's knowledge of climate change?

There are also factors that hinder the public's knowledge of climate change. Lowe et al. (2006) state that climate change is one of the complex issues and it is difficult to communicate it to some publics. For many, climate change is not yet a perceptible issue and thus not powerful enough to motivate people to be well informed and prepared to take action individually or collectively (Seacrest *et al.* 2000). Bostrom et al. (1994) argue that individual's ideas and perceptions restrict their ability to discriminate effective and ineffective mitigation strategies. Barnett and Campbell (2010) concur with these views believing that climate change

science is impenetrable to lots of people including those in the Pacific. They also identify ‘inside and outside knowledge’; whereas the amount of information disseminated to the public is entirely handled by the insiders. As a result, local communities may struggle to comprehend the relevant information. The media dissemination and language deployed by insiders regarding climate can be sometimes misleading and cause fear instead of disseminating constructive knowledge about the issue. Barnett and Campbell echo the importance of building public understanding of climate change, “its uncertainties and possibilities for response, to enable people in communities (and government) to engage meaningfully in adapting to climate change” (Barnett & Campbell 2010 177).

Since climate change is substantially science oriented, (Wratt *et al.* 1991) argue that it has become a big concern to a wide range of people including politicians, government policy advisors, industrialists and the public in general. There are areas of uncertainty that hamper the way the issue is understood by the public. One of the major areas of difficulty concerns the prediction of greenhouse gas concentrations. Current estimates of sources and sinks of carbon dioxide do not balance exactly globally. The IPCC report highlights that predictions of regional details of climate change are less certain than predictions of global mean changes. As result of these regional uncertainties an accurate estimation of biological and social impacts will be difficult to obtain (Wratt *et al.* 1991) Therefore, they suggest that it is reasonable to carry out research which focuses on matters of particular importance to a particular part of the world and topics where people can make special contributions to global knowledge.

CHAPTER THREE: METHODOLOGY

3.1. Semi-structured interviews and focus groups

Throughout the history of social science research, interviews have notably been one of the accepted modes of collecting data to gather information from participants (Matthews and Ross 2010). There are three forms of interviews: structured, unstructured and semi-structured (Longhurst 2010). This research adopted semi-structured interviews to collect data from the participants. The research also aims to collect qualitative data.

3.1.1. Semi-structured interviews

Semi-structured interviews and collecting of qualitative social data are appropriate due to the main interest of the researcher being primarily positioned on experiences, behaviour and understandings of people and why they perceive the world that way. Semi-structured interviews are directed by an interview schedule prepared by the researcher, following certain criteria but including "flexible questioning" (Dunn 2005).

3.1.2. Focus groups

Focus groups typically consist of six to ten people who discuss a particular issue provided by a researcher. The focus group no longer focuses on the interview background but the discussion is extended to exploring issues regarding the people, the government and the environments (Cameron 2005). Small focus groups with four to six participants are becoming more common due to the participants being more comfortable in small groups than the larger ones, and it is also easier for researchers to get participants (Krueger and Casey 2000). Focus groups are slightly different from semi-structured interviews because their key characteristics are interaction among people. This interactive feature of focus group allows participants to discover wide range of views and to rethink their contributions to the discussion (Cameron 2005).

Focus groups are an ideal method of collecting data because of their capability to explore the socially constructed nature of knowledge. This is achieved by gaining

"multiple meanings that people attribute to places, relationships, processes, and events that are expressed and negotiated, thereby providing important insights into the practice of knowledge production" (Cameron 2005 117).

3.2. Pacific Research methodology

In this research, the conducting of semi-structured interviews and the focus groups were guided by models adopted from the Pacific Research methodology. These models are: [10]*Kakala* by Thaman (2011), and [11]*Talanoa* by Vaioleti (2006). Since the people of Tonga are the focal point of this research, one of the key factors that is more likely to impact on the responses of the participants is the relationship maintained between myself as a researcher and the participant. Thaman (2010 355) argues that in the Pacific, "relationships are important because they are central to personal as well as group identities and they provide the frameworks for appropriate behaviour and performance". Kalavite (2014) concurs with Thaman by providing one framework inherent to Pacific research methodologies: the extended family framework, also known in Tongan as [12]*kāinga*. A mutual relationship between the researcher and the *kainga* is established and they trust each other as families (Kalavite 2014). There is a growing consensus that the researcher will make use of the information while the *kainga* will benefit from the research as a whole (Kalavite 2014). Vaioleti (2006) emphasises the importance of relationship in Pacific research. The western research methodology undergoes certain protocols. For instance, the interactions have to be aligned with the approved ethics. Vaioleti (2006 22) states that:

> The disparity between the objectivity base of much traditional research and the subjectivity of the participants is often not recognised in Pacific research contexts.

Vaioleti (2006) clarifies this by pointing out that conducting research in the Pacific context, the researcher's age, gender, cultural rank or position in the

[10] Sweet smelling flower of any kind.
[11] To talk in an informal way, to tell stories or experiences
[12] Relative, relation, extended family in the Tongan context

community that will shape the participant's behaviour towards the interview and this may impact the results.

3.2.1. *Kakala*

Metaphorically, Thaman (2011) induces the procedures of making a garland of flowers to illustrate the concept of Tongan research methodology. The making of garland involves three distinct processes: [13]*toli*, the picking of the flowers, *tui*, the making of the garland and *luva*, presenting the garland of flowers to the wearer. During the *toli*, different flowers are selected to make the garland and women often look for flowers with sweet smell or beautiful flowers. The *tui* is carried out cautiously to ensure a beautiful *kakala* is produced and then it is presented it to the wearer.

Thaman's idea of *toli* is referring to when the researcher gathers information required for the research. [14]*Tui* is when the researcher grouped the information, analyse and then write up the findings. *Luva* is when the researcher presents his or her findings to the public. The metaphor of *kakala* is predominantly applicable to this research. I had to undergo these three processes: my fieldwork was conducted on the island of Tongatapu, I utilised *toli* when I participated in semi-structured interviews and group focus to collect the required information. I grouped them out, analysed them, then I am writing up a report, the *tui*. The final step is the [15]*luva*, this is when I complete writing up a thesis which I present this to the people of Tonga and the government hoping the information it contains will benefit the country.

3.2.2. *Talanoa*

Talanoa can be interpreted as a "conversation, a talk, an exchange of ideas or thinking, whether formal or informal" (Vaioleti 2006 13). Morrison *et al.* (2002) state that *talanoa* is an applicable research method for Pacific researchers because relationship is paramount for most Pacific activities. Vaioleti (2006 25) also claim

[13] Process of picking flowers for making garlands
[14] The process of making the garland
[15] Process of presenting the garland to the wearer

that *talanoa* "removes the distance between researcher and participant, and provides research participants with a human face they can relate to".

Talanoa was the major methodology that was employed by this research to collect information from the participants.

3.3. Recruiting participants

3.3.1. Semi-structured interviews

I intended to engage a diversity of participants in order to obtain a breadth of data. Aligning with the basic goal of this research, to uncover the people's understanding of climate change in Tonga, a specific target group was not identified so the selection of the participants was done randomly. Krueger and Casey (2000) believe that this procedure is bias free in selection, so each participant has an equal chance to be involved in the research tasks. My existing networks in Tongatapu effectively assisted me in recruiting my participants. I employed the snowball technique to collect names of other possible participants. I sought assistance from a friend of mine in Tonga to find my research participants so when I arrived Tonga, I was provided with some names to start with. When a participant believed he could not help, he or she was asked to direct us to another possible participant or he or she would direct us to the town villager.

I conducted a pre-visit to all of my participants except two focus groups. These focus groups were on teaching practicum and they were only available for the day of the interview. On that visit, I explained to them the nature of my research, discuss the information sheets and the consent forms. I organised a time to phone them again in a day or two to confirm whether they were willing to participate or not. However, the majority of the participants signed the consent form on the day of pre-visit. So, we set the meeting dates, times and locations for the interview. According to Krueger and Casey (2000), we arranged a time that did not crash with their family or church activities. I also did a reminder contact: I phoned the participants the day before the interview to remind them and to confirm their willingness to participate.

The total number of semi-structured interviews was 30, with15 males and 15 females aged between 18 and 75 years old. The gendered characteristics of local knowledge must also be recognised as they contribute to furthering the existing body of knowledge on climate change (Lane and McNaught 2009). These participants were from different locations on Tongatapu. The original number of target villages was four, however, I decided to extend the number of villages to eight. I sought to explore how people from different parts of Tongatapu, from the coastal settlements and those who live inland, from the urban areas and rural villages considering that their range of views would produce a cross section of perspectives. My participants were selected from these villages:

1. Kanokupolu

2. Ha'atafu

3. Vaini

4. Talafo'ou

5. Kolonga

6. Nukuleka

7. Popua

8. Sopu

(See Figure 3 for the location of these villages on the map of Tongatapu)

I was also honoured to have an opportunity to interview one of the workers from the Ministry of Environment and Climate Change. There was an in-depth discussion on the designed framework for adaptation such as JNAP (2010). The nature of this interview was remarkably informative, I was also given substantial information and resources such as digital copies of the JNAP (2010), SNC (2012), brochures about climate change and other resources as well. Some specific villages such as Nukuleka and Kanokupolu were highly recommended by this participant as being worth visiting and conducting interviews in.

3.3.2. Focus groups

There were three focus groups involved in this research.

Focus group 1: Teachers from Tonga Institute of Education

Focus group 2: Students from Tonga Institute of Education

Focus group 3: Women from Fatumu village

These focus groups ranged from 5 to 6 participants. Conducting small focus groups allowed members to feel confident and also gave them more time to be involved actively in the group discussions. Small focus groups are easy to handle, and enable each person to convey messages in an open environment.

3.4. My role as a researcher

Being a researcher undertaking qualitative studies, I am aware that there is a variety of roles employed while I am in the research setting (Unluer 2012). I can either play the role of being an insider-researcher or an outsider-researcher. An insider is when the researcher is a member of the group being studied and an outsider is when the researcher is a complete stranger (Adler and Adler 1994). In my case, I played both roles concurrently. Being a Tongan researcher doing my study on my own cultural and social setting boosted the positive relationship between my participants and me. Adopting the *talanoa* methodology was not a conflict to my research. Bonner and Tolhurst (2002) identified three key advantages of being an insider-researcher: first, the researcher has a better understanding of the culture being studied; second, the researcher is well adapted to the flow of social interaction and third,: he or she will have established a prior relationship promoting both the telling and the judging of truth. My familiarity with Tongan values and practises had contributed to enhancing the closeness and effectiveness of the *kainga* framework that Kalavite (2014) stressed. Speaking fluently in Tongan also attributed to a more informative discussion. This is particularly applicable to addressing participants over the age of 60. In terms of approaching this age group, one has to go through some protocols especially with the words used have to show respect. Being an insider-researcher is rewarding but

at the same time, you can go through some pitfalls that may affect the outcome of your research. Bonner and Tolhurst (2002) argue that over familiarization with the setting might leave me as a researcher to make assumptions about what I was observing without searching for appropriate underpinning actions. This is coincided with my position as a researcher. It was tough forcing myself not to make assumptions which might be emerged from the existing knowledge that I already have.

As mentioned before, I was also an outsider-researcher. Being a Tongan researcher that left Tonga for number of years, and the fact that my representation as a researcher from a New Zealand institution did impact on the participants' responses. This was clearly illustrated when I conducted one of the focus groups in my very own village of Fatumu. I comprehended the fact that the participants and I had created a bond prior to my migrating over to New Zealand. However, I could pinpoint from the way they discussed the issues, that regardless of that prior relationship, they were treating me as an outsider-researcher.

3.5. Limitations

This research had some difficulties. One of the problems that I went through was the weather. During the period of my fieldwork in Tonga, Cyclone Kofi was announced. Therefore, the interviews that were allocated for that day were postponed. However, there had been a continuous heavy rain and strong wind after the cyclone warning. The focus group that was conducted in my village, happened on a rainy day. As a result, the participants were asked to raise their voices up so that we could be able to hear one another. Travelling during the rain and strong wind was very risky in Tonga, but it came to a situation where I could no longer keep delaying it, so I had to travel to where the interviews were to take place.

The language was also a problem as it created confusion amongst the participants. The majority of the interviews were conducted in Tongan, and it was difficult to translate scientific terms related to climate change such as greenhouse gases. Often people lacked the understanding of the UNFCCC and Kyoto protocol so the discussion was limited only to what they know. I also came to identify some

dominant members in some of the focus groups. As a researcher, I also regarded myself as a facilitator, my role was to ensure that there was an equal chance of contributions being given by each participant. The students from the Tonga Institute of Education were on their usual three weeks practicum. The teachers too, rearranged their busy schedules to fit with my timetable. Since these participants were busy professionals, I did my best to get the focus group done as their contributions are highly appreciated.

CHAPTER FOUR: UNDERSTANDING AND EXPERIENCING CLIMATE CHANGE

4.1. What is climate change? Tongan's interpretation of climate change

The results gathered from this research indicate that the people of Tongatapu are aware of climate change which is known in Tongan as [16]*feliuliuaki 'o e 'ea.* All of the participants have heard of *feliuliuaki 'o e 'ea* and they believe that it is a big issue in Tonga today. Since the interviews were conducted in the Tongan language, I tried to familiarise myself with the term *feliuliuaki 'o e 'ea*, according to the translation produced by the Ministry of Environment and Climate Change (MECC). Although awareness of climate change is considered high among the participants, their individual definitions and interpretations of the term itself varied from person to person. However, some definitions were similar.

4.1.1. Natural phenomena or human induced activities?

About ninety percent of the participants developed their definitions of climate change from their own individual experiences. [17]*"Oku kehe 'aupito 'ae 'aho ni ia mei he 'aneafi"* meaning "Today is different from yesterday" is the most common response from the participants. When asked to clarify the differences, the participants went into more depth to name the changes that they have encountered so far. The participants between the age 55 and 75 defined climate change according to the differences they witness today compared to what they had experienced twenty to thirty years previously. Their discussions were basically centred on the 'strange nature' they observe today such as the inconsistencies in the duration of seasons, increased and decreased rainfall, increased temperature and increased frequency and intensity of tropical cyclones. Susana, aged 55, who resides at a western village in Tongatapu said:

> We used to have a special bond with nature and it was like a culture. And there was a special way of communication with nature.

[16] Definition of climate change adapted from MECC.
[17] The condition of the climate today is very different in comparing to the past.

> My father used the traditional calendar to find the right time to grow yams and taro.

Paula (40 years old) shared the story of when he was a school student in the 1980's. He attended a boarding school and during winter seasons, they normally put on two blankets to keep warm.

> I remember when I was still a student, I went to a boarding school, and it was cold during winter season. I had to make sure I brought two blankets to school. Today, we don't need any blankets, it's hotter these days.

These participants shared how in the past twenty to thirty years, their grandfathers utilised special traditional knowledge to grow crops. For instance, the [18] *'ufi* or yam is regarded as one of the valuable staples food in Tonga. The preparation for growing *'ufi* requires a certain period of time and is carried out in a unique way. The season for growing '*ufi* is between the months of October and March, and April is the harvest season. From the discussions with the participants, it was clear that this season no longer falls on the right time. Continuous rainfall and extreme hot weather bring changes to what was considered to be normal to the life of the Tongans. The summer season now brings very hot weather, and it affects the crops and the livelihood of people. One participant who is a farmer said:

> In the past, [19]*polopolo* was considered one of the most important events for every Tongans. It was normally occurred in April. Today, the yams are not the same as before, sometimes they are rotten so we have to harvest them one month before. So the harvest season is no longer effective today.

Twenty percent of the participants derived their definitions from what they have learnt from their professional experiences. For instance, Katalina, aged 46 and who works at the MECC, said that she first learnt about climate change at high school and at university, but that was mainly based on theory. Her knowledge about climate change was developed in depth when she worked at the Ministry of Environment. Her definition of climate change was based on scientific knowledge, she said:

[18] Refers to yam, also regarded as one the valuable staple foods in Tonga
[19] A traditional event for presenting the first fruits of crops particularly yams

> Climate change is a natural phenomenon. The role of the greenhouse gas is to pick up and keep the warm sunbeams from escaping to outer space and it keeps the earth warm. There was a certain amount of greenhouse gases given to provide a favourable climatic condition for all living things on earth such as humans and plants to supply their food. Not only that but it also provided food and temperature for all the marine organisms.

The rising of the sea level is also a major concern for the participants particularly those who live along the coastal areas. The formulation of their definition of climate change was based on their experience of sea level rise. The low lying coastal areas are likely to be the most affected places. The residents along these areas have been able to witness the effects of sea level rising. One participant residing at an eastern village on Tongatapu said:

> Climate change is a natural phenomenon, but due to some human induced activities, strange things are happening today in compared to the past. For example, the sea level is rising, and there's a big change on fishing activities. In the past, we had no problem with fishing, it was easy to get food for the family. Today, we hardly get any sea food.

He also believed that being a town officer did help to enrich his knowledge about climate change was developed by the substantial information he had gained from a number of official seminars and meetings he regularly attended. Since fishing is one of the primary sources of livelihood for the Tongan people, the participants stated that climate change is about the extinction of common sea foods such as sea weeds, crabs and fish

As noted previously, Tonga is a Christian country and the people are influenced by their various religious beliefs. I had a chance to talk to one of the church ministers and this is how she defined climate change:

> I can define climate change from a negative and a positive perspective. I believe that if climate change is a natural phenomenon, then it is God's decision; human beings have got nothing to do with it. God's authority is the highest of all, therefore climate change is a positive issue. On the other hand, if human beings have contributed any other activities such as pollution,

> destroying coastal plants, and all activities that are ruining the environment, then climate change is a negative issue.

One of the focus groups was composed of tertiary students between 20 and 26 years of age. Haitelenisa, aged 24 believed that her knowledge of climate change was enriched by the courses she took at the institution she's studying at. She believed that climate change is the changing of climate over time due to natural variabilities as a result of human induced activities like the smoke from fires and the fumes from vehicles. The participants in this focus group strongly placed their emphasis on climate change as a result of human induced activities.

Elone aged 56 believed that climate change is more like political issue these days. He mentioned that there are different terms like conference, Copanhagen, air pollution, natural resources and so forth, but the negative effects and how to reduce those effects are ignored.

There was a very little number of participants that were not responding well. This is due to their lack of confidence and limited knowledge of the issue. They argue that they have heard about climate change on radio, but were not interested enough to know about it.

4.2. Causes of climate change: The worldview upon which participants base their knowledge

Although climate change is a universal issue, the people's awareness of this issue in Tonga was only developed in the past ten to fifteen years. This research enabled us to identify the key worldviews upon which participants base their knowledge in regards to what climate is and what causes it.

4.2.1. Scientific perspectives: Human induced activities

Forty percent of the participants interviewed stated that human activities are the main causes of climate change. Out of these, about ten percent argue that chemical use in both livestock and crop farming contributes to the cause of climate change in Tonga. There are no factories or industrial activities in Tonga; its main source of income comes from agriculture and fishing. However, these participants were not able to clarify why they believe chemicals are the main

cause of climate change. Another twenty percent of the participants considered burning rubbish and cutting down trees to be the cause. Burning rubbish is a normal activity in Tonga. Every home has a rubbish heap in the backyard where different types of rubbish such as empty bottles, plastic bags, televisions and tyres are collected and burnt at any time of the day regardless of the smoke produced. In Tonga today, all rubbish is to be collected and transported to [20]*Tapuhia* (the landfill). Every household in Tonga is aware that burning rubbish is prohibited- a new law that was recently established by the government.

Burning of fossil fuels and industrial activities were mentioned up by ten percent of the participants. One of these participants is working at the MECC while the others are students and teachers at a tertiary institution. Katalina used scientific terminologies that were hardly discussed by others. Her discussion revealed that climate change is due to human activities such as cutting down trees and burning fossil fuels. She also brought to light terms such as methane, nitrous oxide and carbon dioxide. Her points are somehow linked to what others have said but the solidness of her explanation together with the terms she used was more sophisticated than the other discussions. She stated that:

> The Industrial Revolution had resulted in building more factories and industries. As a result, an extra amount of gases were added to the greenhouse gases that naturally existed. Climate change is an effect of the building up of the concentration of greenhouse gases due to human induced activities such as cutting down trees and burning fossil fuels. These activities release greenhouse gases known as methane, nitrous oxide and carbon dioxide. These gases contributes to global warming.

The importing of many vehicles to Tonga was also discussed by some participants as one way in which humans contribute to the cause of climate change. This is due to the exhaust from vehicles. There are not many factories in Tongatapu but they believed, the increasing number of vehicles is not safe for the environment.

[20] Tapuhia: Landfill site in Tongatapu.

4.2.2. Christian worldview

The Christian belief of the participants was fundamental in shaping their definition of what causes climate change. Their beliefs are based on the Bible teachings: According to Genesis chapter one, in the beginning, God created heaven and earth. From the light of the Christian beliefs, fifty percent of the participants stated that climate change is God's plan.

The Bible's prediction

Twenty percent of the participants asserted that the bible predicts that certain catastrophes would happen and these would indicate that we are approaching the end of the world, and climate change is one of them. A wide range of disasters and calamities had happened in Tonga recently, which were not common in the past such as 20 to 30 years ago. One of these disasters was the tsunami that hit the two Niuas in 2009 and some lives were lost. Climate change was regarded by these participants as one of God's predictions.

God's Punishment-Selfishness

Furthermore, twenty percent of the participants contended that climate change is a punishment for being selfish, committing sins and for abusing God's creation. God had created the world and provided everything to satisfy mankind's needs. A church minister expounded that people are not satisfied for what they are given so they tend to utilise the environment to fulfil their needs and to accomplish their own individual goals. This indicates how greedy and selfish humans are. The industrial countries for instance, do not consider the people's life and their environments. Money has become the motivation for their daily actions. God starts to pay us back, and as one participant stated, human beings have destroyed God's creation, so God will do the same to humankind.

4.2.3. Traditional explanations and local knowledge

Only ten percent of the participants perceived climate change as a completely natural phenomenon. This group of people are between the age of sixty and seventy five years of age. They believe that in the past, approximately forty years

ago, there was nothing wrong with nature. The environment was regarded as having the 'balance of nature'. Elderly people were able to predict a cyclone and could foresee a drought that may likely to occur, by applying their traditional knowledge to predict nature, such as studying the moon, examining the wind and sometimes they studied the movements of animals. One participant reflected on how Christmas time, her grandmother liked to predict how the weather would be like in the following year. Her grandmother used to say, "[21]*Ko e ta'u lelei te tau tu'uta ki ai*" which means "We are approaching a beautiful new year". This prediction was proved to be accurate as throughout the whole year, there was no natural disasters occurred. The participants believed that traditional knowledge is sometimes more accurate than the scientific source of information..

On my pre-visit to Sulia, aged 72, there was a hurricane warning that morning. The weather was rough with heavy rain and strong wind. I personally asked her what day she thought I would come back to do her interview, she told me to come the next day because there would be no cyclone. She said: "The wind direction indicates no cyclone is going to happen (she pointed to the direction), it can only bring strong wind and heavy rain, but not a cyclone". On the next day, I went and conducted the interview, the weather was not as bad as the day before.

4.3. The participants' responses to the impacts and implications of climate change

4.3.1. Environment consequences

Sea level rising: [22]*Tahi lahi* (Spring tide)

Sea level rise is one of the most observed impacts of climate change in Tongatapu; about eighty five percent of the participants commented on sea level rise and how it has become a major issue especially on the low lying coastal areas such as Kanokupolu, Popua, Sopu and Nukuleka. According to Katalina, it has been proved internationally that the sea level is rising. For instance, in Tonga, the sea level is rising 6.4 millimetres per year. The participants from the coastal

[21] Traditional knowledge is utilised to predict weather
[22] Spring tide: a major problem to low lying areas in Tongatapu

villages such as Nukuleka and Kanokupolu concurred with Katalina, saying that the impacts of sea level rise are one of the top concerns these days in their individual villages. In the village of Nukuleka, the participants stated that in the past twenty years, the sea water was fifty metres away from the coastal vegetation and there was beautiful sand. Today, the sandy beach is covered with water, and this was a clear indication to them that sea level is rising. The coastal site of Talafo'ou village is also affected by sea level rise. Pita, aged 70, from Talafo'ou believed the whole village will soon drown.

> We used to have a beautiful sandy beach for our children to play, the sea water has moved further inland today, during the '*tahi lahi' or* spring tide, coastal area is flooding, and for those who lives close by to the sea, they have to evacuate.

Figure 8. Coastal area of Talafo'ou village showing sea water cover almost the sandy beach (Source: Author)

Figure 9. A coastal settlement in Talafo'ou village, showing a site that was covered with sea water in the previous week. (Source: Author)

The increased intensity of tropical cyclones in Tongatapu had affected both the environment and the people and their livelihoods. Coastal vegetation is uprooted and this further increase the possibility of coastal erosion (See Figure 10). Houses are destroyed and the people are emotionally disturbed.

Figure 10. A coastal plant in Nukuleka village that was uprooted by a cyclone

(Source: Author)

Social and community repercussion

Water supply

The water supply in some locations in Tongatapu such as Kanokupolu village is under threat. This is due to the underground water being severely affected by the sea level rise. Since underground water is a very common water source for villages in Tongatapu, it is likely that the majority of the water supply of Tongatapu will need further investigation in order to supply safe water for the people of the island. All the participants that I talked to had reported that the groundwater was unsafe for drinking. They said, the underground water is only for household tasks such as washing, cleaning and bathing. The whole village depends on rain water tanks for drinking and for cooking.

[23]*Tau o ki Valu*

Tau o ki valu was a phrase that was commonly used by fishermen in the past to advise other fishermen of a potential fishing ground. This was one of the traditional ways of fishing and according to the participants, there was sufficient fish for the family and the neighbours. The remaining fish were sold in order to earn some cash for the family. *Tau o ki valu* is not carried out any more these days, as one participant stated:

> The jelly fish known as [24]*ma'anu* is one of the sea foods that no longer exists today. *Ma'anu* was a staple food since it was free and easy to catch. The other type of jelly fish known as [25]*toka* can still be fished today, but according to the participants, the *ma'anu* is the delicious one and the Tongan people still prefer it. However, the increased temperature was considered to be main cause for the disappearance of *ma'anu*.

[23] A traditional fishing method that no longer exists today
[24] Type of jellyfish very popular for Tongans but very hard to catch today
[25] Also another type of jellyfish

Effects on culture

Traditionally in Tonga, respect demanded a certain dress code. Girls wearing very short skirts and sleeveless tops were not acceptable. Girls ensured that their whole body is covered especially when males are around. Respect between brothers and sisters was one of the most fundamental aspects of Tongan culture. Because the weather is extremely hot these days, people dress in a way to suit the weather. According to the participants aged sixty to seventy five, this way of dressing puts shame on the family and ruins the culture too. According to Sione aged 71, he said that:

> Some people are blaming the weather for what they are wearing. I don't like looking at my granddaughters in miniskirts and sleeveless tops. That is very disrespectful. I had to tell them off. I do not like it.

Strong community network

There are villagers in Tongatapu who have found climate change a positive way to enhance and bring the people together. There is a close network built among members of the community and they are willing to help each other for the benefit of the whole village. One town officer was proudly explaining that the spirit of working together is remarkable in his own village. He is aware that every family is struggling with financial matters, but when a fundraising project is announced, these people donated with their hearts. Some families have little in the way of income, but they go out fishing and sell their catch to get some money. He found the efforts that put in by the people of this village very remarkable.

Impact on health

The impact of climate change on the people's health was discussed by more than fifty percent of the participants. The extreme hot weather was believed to be the main cause of the people's health problem. One participant, 72 years of age, agreed that the number of people who are visiting the hospital is dramatically increasing these days. Every time she goes to a doctor appointment, she finds huge number of people awaiting a doctor consultation. Some participants believed that there is an increased number of deaths due to the weather condition. 'Sudden

death' has become a common cause of death in Tonga recently, and they believed the unfavourable condition of weather affected may people's life. Skin problem has become another major concern to some participants and they thought the heat from the sun is the main cause.

4.4. Economic significance

The impact of climate change on agriculture and on fishing caused a major blow on the economic life of both the people and the country as a whole. The long periods of drought destroy crops and there is a decline in agricultural production. Furthermore, the sea level rising can also cause soil salinisation, and crops cannot survive in such unfavourable conditions. Families who earn their living on agriculture will struggle. Fishing is also another source of income for the Tongan people. The decline in the number of fish, the migration of tuna to other areas and seafood scarcity have affected many families' income. Because agriculture and fishing were ones of the main sources of income for Tonga, Tonga's economy will be badly affected too.

CHAPTER FIVE: RESPONDING TO CLIMATE CHANGE

5.1. Possible routes to adaptation and mitigation

5.1.1. Initiative from grass root level

Elone, a teacher at a tertiary institution stated that there should be an initiative at grass roots level to empower people with appropriate knowledge. He believed that those with the appropriate knowledge of climate change, for example the workers from the MECC, should introduce the knowledge starting from those at the grass root level. He stressed that the people of Tongatapu have the right to obtain substantial knowledge of the issue. This view was also shared by Taniela, also a teacher in a tertiary institution. He argued that there are adaptation plans formulated by the government, however, these plans are not disseminated well to the grass roots people in the communities. Taniela stressed the significance of women in communities and how powerful they are these days if they can act as messengers to provide the people of the community with necessary information about climate change. Development by women is well recognised in every village community. For example, in most villages in Tonga, women groups conduct programmes such as home inspections. This programme is primarily designed to ensure that every home is well looked after, there is a flower garden, a vegetable garden and the house is clean and safe for the every family members. Taniela believed that in the village context, women is the first potential group to be educated.

Strong community engagement

In the light of this research, I discovered that working together as a team is a powerful weapon to fight against climate change. One church minister spoke from a biblical point of view, that [26]'*fepoupouaki*' or 'collaboration' is one of the fundamental keys to build a strong community. In the context of climate change, the idea of teamwork is required in order to adapt to climate change.

[26] To support or help one another, or work as a group

Kanokupolu is one of the villages in Tongatapu, where community involvement was highly identified. For instance, the construction of the sea wall (see Figure 11) was financed only by the people of the village. According to the participants, the people of the village carried out fundraising such as concerts and their relatives from overseas also contributed substantial amounts of money to build the sea wall. There was no funding from the government.

Figure 11. Sea wall at Kanokupolu coastal site

(Source: Author)

The combined efforts of the people of Kanokupolu made it possible for them to design one access route to the beach and named this road as '*Hala Tafengalolo'* (see Figure 12).

Figure 12. Kanokupolu Village: Coastal environment Rules (Source: Author)

Box 1.1 provides a translation of the notice

TAFENGALOLO ROAD

This road regulation was established under a negotiation between the Police Department and the village committee to protect the coastal area and is policed by the town officer of Kanokupolu Village.

- Weekdays: closed from 6pm-6am
- Weekend: closed 6pm Saturday- 6am Monday
- No one is permitted to go to the beach when the gate is closed. This is due to: unwise actions such as stealing fishing equipment, stealing pigs, removing coastal vegetation and destroying constructed sea walls.
- Locals are not permitted to drink beer and litter the beach.

Regards: Kanokupolu village committee.

5.1.2. Water supply

According to the MECC, project on accessing other means of water source apart from underground water is considered one of the top priorities. As shown in Figure 13, this billboard was designed by the MECC to ensure that various sites that are vulnerable to the rising sea water are addressed with proper adaptation options. These sites listed on the billboard, Ha'atafu, Kanokupolu, 'Ahau, Kolovai, Ha'avakatolo and Fo'ui villages are the main focus areas of this project. The participants of Kanokupolu indicated that their water source is contaminated by sea water, therefore, it is very unsafe to drink. This community had cooperatively participated to ensure each home builds a water tank [27]*sima vai* to collect rain water for drinking.

Figure 13. Billboard showing adaptation project on water (Department of Climate Change (Tonga)).

With funding from the government, some families in the village were offered free water tanks (See Figure 14). Others were asked to build their own water tanks. Figure 15 shows a home in Kanokupolu with a rain water tank that was funded by this family only.

[27] Water tank

Figure 14. Home at Popua settlement showing green water tank funded by the government (Source: Author)

Figure 15. A home at the village of Kanokupolu showing water tank built by this family on their own (Source: Author)

5.1.3. Projects on litter

Kanokupolu and Ha'atafu were two villages that had implemented programmes avoid burning rubbish as they believed burning contributes to causing climate change. One of these programmes was to reinforce the recycling of cans (See Figure 16) so that the people will not burn these cans. Burning is prohibited in

Tonga and it has become law. However, it is not sufficiently enforced by the government as people are still burning their household rubbish. There is a strong working ethics being enhanced in Ha'atafu village and this is especially to do with the youth community. One of the participants stated that the youth group at Ha'atafu are actively participating in picking up litter. The youth are be able to classify the rubbish and put the recycling ones aside. One of the initiatives that is being employed in this project is that every child who manages to fill a bag with rubbish will get fifty cents. There is positive feedback from this programme and the idea of recycling is reinforced simultaneously.

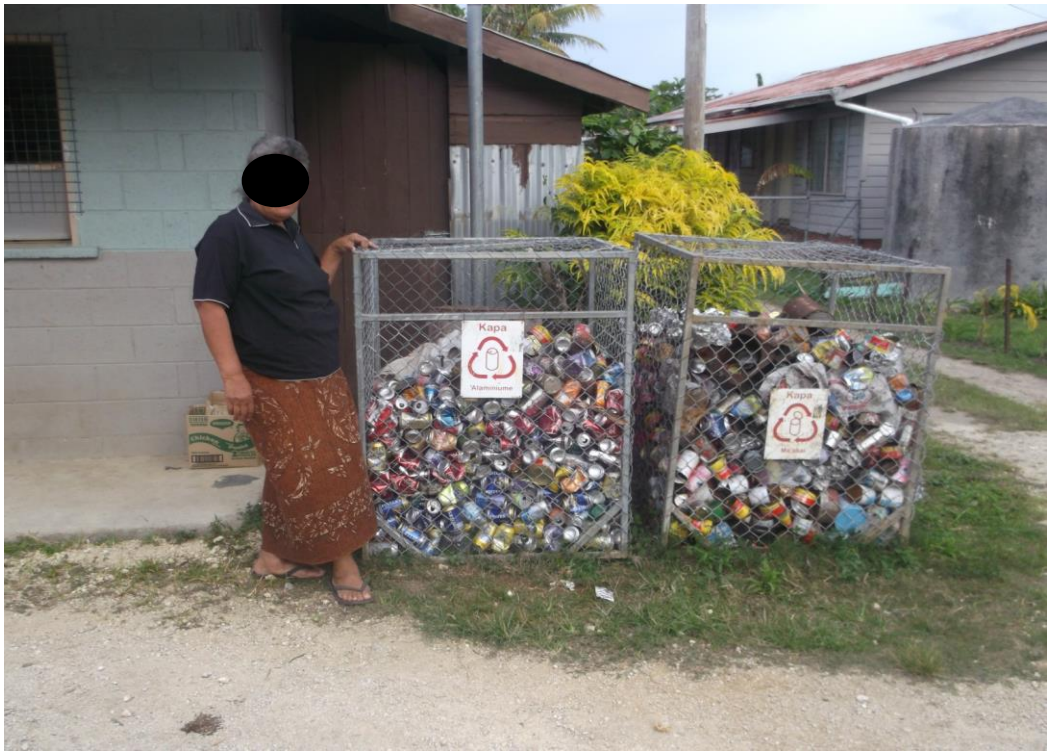

Figure 16. At Kanokupolu village, recycling process is highly recommended (Source: Author)

5.1.4. Top-down responses

According to the Tonga JNAP (2010), the Ministry of Environment and Climate Change is the National Executive Agency for climate change activities. Other

committees such as the National Environment Coordinating Committee (NECC), the Technical Working Group (TWG) and the Management Unit (MU) were established and approved by the cabinet. The principal role of NECC is to act as the advisory body for all environmental projects including climate change. Members of each group are mainly technical experts from government agencies, department heads from government ministries and representatives of non-government organisations and statutory authorities. The group deals with the proper implementation of climate change activities at the technical level (JNAP, 2010).

I have discovered from this research that some villagers in Tongatapu are not pleased with the Department of Climate Change. They blamed the government for its lack of cooperation and they believed was its failure to keep to its words. The residents of Sopu and Popua areas are complained about ongoing flooding especially during spring tides, but the government has not done anything yet (See Figure 17). Some participants believe that the Government has prioritised things according to its own needs. They believed there is substantial funding from overseas donors but it is not distributed well.

Figure 17. A house at Popua settlement indicating high vulnerable to sea level rise. (Source: Author)

5.2. The barriers: Factors which prevent full understanding of and responses to climate change

This research has revealed not only the degree of awareness of the people in Tonga about climate change, but it also unveiled certain factors that prevent full understanding of people and limit their responses. These factors are pertinent in considering what is required to be done in order for the people to gain a decent understanding of the issue. They were discussed by the participants based on what they have experienced and observed in their own village settings.

5.2.1. Low socio-economic status

The majority of the families in Tongatapu do not have a full access to technology such as internet and television. Families with no fixed income cannot afford to buy a radio, a television or even a newspaper. A participant said that there are programmes running on television to educate people about the impacts of climate change, but she does not have a television in her house so it is impossible for her to access to this information. She suggested that she will be better off if a group from the climate change department would visit her house and talk to her in person.

5.2.2. Lack of education

A substantial knowledge of how to deal and manage the environment wisely can be obtained through education. Education plays a vital part in disseminating environment issues including climate change to the public. Lack of education here not only refers to the formal classroom setting but also the lack of public and community awareness programmes to disseminate the climate change information to the public. Interviewing participants who were professionals such as school teachers and tertiary students, their discussions of the issue were well defined and supported with clear examples. In comparision to those participants who were homemakers and unemployed, the awareness is there, but the knowledge is superficial and sometimes misguided.

5.2.3. Biblical convictions

There is a long term mentality that people of Tonga have been living from generation to generation, known as '[28]*Tau lotu, he koe 'Otua 'ofa, te Ne fakahaofi pe kitautolu',* (God is a loving God, and with our prayers, He will save us). About forty percent of the participants believed that this biblical conviction has been blocking people's understanding of climate change. The Christian beliefs of the people had played a fundamental role in shaping their perspectives about environmental issues. Their conviction is based on the point that God has created everything on earth including the sun, the rain and the clouds. Many even claimed climate change was created by God. And, because "man" is the top of His creation, then He will protect them from temptation. The people believed, even if there is sea level rise, there is drought and continuous cyclones, God will save them.

This paradox had induced many people in Tonga particularly the older ones to stay away from the belief that climate change is an issue that is worthy of consideration. Sixty per cent of the participants expressed a sense of concern about those people who still think that way. They brought into light the fact that God had a desire for humans that they cannot just sit and pray, they are required to act at the same time in order to be saved. One of the participants said:

> '[29]*Ko e lotu moe ngaue'*, Prayer has to be aligned with action. Some people especially the older ones, believe that things happen according to God's desire, they even believe that climate change is sent by God. They often criticise the scientific knowledge saying; '[30]*koe to'utangata fiepoto eni, 'oku mei he'Otua 'a e me'a kotoa pe*' (This generation is trying to sound smart but what is happening these days is God-given). For me personally, this kind of aphorism should be stopped.

Tongans' Christian beliefs on Armageddon influenced their perceptions about climate change. As discussed earlier in this section, the participants simultaneously relate today's tragic events to what they are learning in the bible.

[28] With our prayers, we will be saved. A belief that is typical to most Tongan people
[29] Prayer and action are correlated: you have to pray and act at the same time
[30] Typical notion from older generation that young educators are trying to sound smart.

About fifty per cent of the participants agreed that God's time is near. The continuous occurrence of natural disasters such as flooding and tsunami and the disasters caused by man such as wars, the bombings, and the killings and climate change are the literal signs of Armageddon.

5.3. Approaches for addressing the knowledge deficit

This research has unveiled factors that influence the understanding of the people of Tonga about climate change. What is clear from the findings that most of the participants are aware of the issue; but majority of them could not comprehend the story that surrounds climate change. The participants were asked to provide strategies that would help to address the knowledge deficit of the people of Tonga, and the following approaches were discussed by them to ensure that every person would be able to access the appropriate information on climate change.

5.3.1. Role of churches

In Tonga, every person belongs to a particular church group. The churches play an essential role of sustaining the spiritual beliefs of their members and ensure that they feel safe and secure. Church communities can be regarded as the most powerful group in every village in Tonga. Nearly ninety per cent of the participants agreed that climate change can be disseminated perfectly to the people through church services and meetings. When a [31]*fono* or a village meeting is announced, not even half of the villagers will attend. The town officers are struggling with getting people to attend *fono*. In contrast, the church ministers do not find it a problem to bringing people to church; family members proactively attend church. They are eager to get involved in church choirs, attend church meetings and also willing to donate some money.

The participants believe that the church ministers are the right people to distribute the information of climate change to the rest of the communities. The church minister is most likely to have the most powerful voice in the village community. Therefore, there is a possibility to educate the church ministers with the necessary information about climate change. It is paramount to take note that not everyone

[31] Village meeting that is conducted either by the district officer or the town officer.

in the community has the same mentality therefore, one can expect everyone to understand climate change at the same level. It is essential to start from the lowest level, and ensure that every family in the church community is provided with a good amount of information.

5.3.2. Public awareness programmes

One of the most effective ways to improve public's understanding of climate change issue is to design some public awareness programmes. One of the suggestions was to run a 'Climate Change Awareness Week' similar to the 'Cancer Awareness week' that is run by the Ministry of Health every year. Within this week, a range of competitions should be designed to gain full participation from the public. One of the programmes was to run a school singing competition on a given theme such as 'We are the future'. Every school in Tonga could join in the singing competition. At the same time, the organisers of the week will have to seek sponsorship in order to prepare good prizes for all categories. Other approaches may include essay, poster and speech competitions.

The idea of designing posters was formulated in order to stress the true image of climate change. There are number of billboards disseminating the danger of smoking, speeding and telephone company advertisements. According to the participants, these billboards are there to provide them with important messages. One of the participants believed that every time she drives, those billboards are really helpful in reminding her to slow down. She stated that it will be very effective if the impacts of climate change or ways to reduce the issue were displayed on billboards. This notion was well discussed by one of the focus groups, when a participant stated:

> Tongans have different kind of learning styles. There are group of people who do not have television, and cannot read newspapers but I am pretty sure, they learn best from studying static images, so I believe billboards will be a good idea.

5.3.3. Visitation from MECC

According to eighty per cent of the participants, the consultation group of the MECC should visit to every village in Tongatapu. Everyone in Tonga is entitled

to know about this issue because it affects them all. About fifty per cent of the participants said that there is no consultant group visiting their villages, so they believed that in order for the people of Tongatapu to know about climate change in more in depth, then people who have the knowledge about climate change should give out the appropriate information to the people of Tongatapu.

5.3.4. Media dissemination

The media plays a vital role in disseminating information to the public. Special attention was given to the amount of information given out by various media such as television, radio or newspaper. The participants were aware that the people of Tonga have access to different types of media, at different times and different places. They suggested that different groups of people access different sort of media. For example, some people are in favour of reading newspapers but not interested on watching television or listening to the radio. One participant stated that climate change should have a column in every newspaper in Tonga. The more the people are exposed to a substantial amount of information of climate change, the more possibilities their understanding about the issue will be upgraded.

5.3.5. Role of education

In a special interview with Katalina, she insisted that the Department of Climate Change has been working closely with the Ministry of Education. One of the intentions is to include climate change in the school curriculum. The majority of the participants agreed that teaching climate change to the young people will impact them in good ways. One of the primary school teachers said, that the children in his class can only learn about climate change during the science lesson. He argued that the school curriculum should include climate change as one whole subject similar to the other subjects such as Maths and English.

CHAPTER SIX: DISCUSSION

In this chapter, the approach of 'social constructionism' will be applied to the findings to pinpoint its applicability to this research. The three research questions outlined in the first chapter have been addressed substantially in chapter 5. However, it is fundamental to observe how the chosen theory helps explain the participants' responses. Therefore, this chapter will look at how the approach of social constructionism is fundamental in understanding how climate change, is interpreted, identifying the impacts of climate change and how decisions have been made or been planned for adaptation and mitigation measures on Tongatapu. Social constructionism was not formulated by one particular theorist; therefore this discussion will employ range of views from different literatures. However, these views are inextricably entangled as they all lead to one end, that the understanding of the world by individuals and groups is culturally and socially constructed.

6.1 Tongan's knowledge of climate change

One of the key intentions of this research was to discover how the people of Tongatapu define and understand the term 'climate change'. The research unveiled that they conceptualised climate change differently from the definitions used by the IPCC and the UNFCCC outlined in chapter 3. Nearly ninety percent of the interviews were conducted in Tongan language while the remaining ten per cent employed both English and Tongan. As mentioned in the previous chapters, '*feliuliuaki 'o e 'ea'* was the term that was constantly used during the interviews (according to the translation designed by the MECC). Drawing upon the work of Pettenger (2007), it is paramount to explore how climate change is recognised, conceptualised, understood and constructed by different contexts because it may unveil the hidden meaning lost in the face of climate change.

6.1.1. Constructed meanings

Based on the findings, the majority of the participants derived their definition from the Tongan meaning of the term. '*Feliuiuaki*' is the Tongan word for unstable, variability, changeable and inconsistent. The term ''*ea*' is used explicitly to define weather and climate, there is no specific Tongan word to differentiate their meanings. More than sixty per cent of the participants believed that climate change simply referred to climate variability, the continuous change of the weather condition on a daily basis. They argued that *feliuiuaki 'o e 'ea* is a natural phenomenon. This is consistent with Pettenger's work (2007 5) as she believes that the language used to discuss and describe climate change is "value-laden' because the term can have different meanings depending on who is discussing the topic. The interpretation of *feliuliuaki 'oe 'ea* was not something that the people of Tonga developed themselves, the meaning was constructed by a group of people such as the MECC. This is related to Burr (2003); who believes that the ways in which we understand the world and the concepts that we use, are historically and culturally specific. We do not find meaning but we make it and the meaning we make is affected by our social interpretation of the thing (Burr, 2003).

The meaning of the term is interpreted according to the social milieu of the participant. This is highlighted by Barnes (2009) that the that social context of individuals and groups constructs the reality that they know and that knowledge is correlative to the social milieu of the inquirer, the outcome of an ongoing and dynamic process of fabrication. For example, the definition made by Haitelenisia (a student teacher) was different from Pita's definition (a farmer). Haitelenisa was be able to talk about the scientific story that was based on scientific discourse, while Pita's explanation focused mainly on his experience. Fewer than twenty per cent of the participants are professionals, some of them are graduates who work at the government departments; some are tertiary institution students; and some are primary school teachers. Their knowledge of climate change was distinctly different from the rest of the ordinary participants, the majority of whom are self-employed (e.g.: home makers and fishermen). During the interviews with the group regarded as professionals, they defined climate change adopting the

meanings from the IPCC and UNFCCC. The science of climate change was constantly addressed by this group. For example, one mentioned that 'methane' and 'nitrous oxide' are gases that contribute to the cause of climate change.

6.1.2. Connection with nature

Mahina (1993) made a powerful argument on the relationship of Tongan people and nature whereas nature is perceived by Mahina as the root of Tongan people. Hau'ofa (2008) concurs with Mahina by enlightening interested readers with the notion that the ocean is part of Pacific people's life and thus their culture is a product of the interaction between the people and the sea. This proved to be applicable during the course of the interviews. The participants between the ages 60-75 explicated their definition of climate change based on the harmonious relationship between them and nature thirty to forty years ago. However, this relationship has been shattered with repercussions on how these people view nature. Examining how knowledge is being socially constructed, Castree's (2005) work complements this study's findings about how Tongans associate with nature and how their view of climate change was constructed. He believes that knowledge is obtained through observation, interaction with others and interrelating with the material world. Some participants based their discussion on their own experiences and their interaction with others. For example, one participant said that she developed her knowledge about climate change from some church meetings and conferences that she used to attend. With her own observations and experiences based on what is happening in her village such as poor crop productivity, she was be able to construct the meaning of climate change in her own way.

6.1.3. Power of religious belief

Berger and Luckman (1967) stress that knowledge is developed, transmitted and maintained in social situations. Burr (2003) agrees to this notion by stating that our knowledge of the world is co-constructed among people. This research revealed that the Tongans and their Christian beliefs are inseparable. Every individual person belongs to a church, either a church that she or he was brought up with or one that he or she has chosen. Therefore these religious beliefs are

constructed among people, for instance, between church ministers and the people. As discussed by Berger and Luckman, this knowledge is transmitted and maintained in social situations. About sixty per cent of the participants based their knowledge of climate on biblical testimony. Some participants claimed that climate change is a sign that Armageddon is near. They believe the bible and the message it conveys. Others suggested that it is a form of punishment. God has created the earth for the benefit of humans (White 1967) but unfortunately, they had ruined His creation. These interpretations were constructed according to the religious beliefs of the participants.

6.2. Impacts

The TNC (2012) asserts the geographical location, geological composition and socio-economic features of Tonga contribute to its susceptibility to the impacts of climate change. They posed adverse effects on the environment, the people and their livelihoods. Campbell (2014) presents five impacts of climate change such as sea level rise, declining quantity and quality of water resources, coral reef bleaching, poor agricultural productivity and effects on human health. Some of these impacts were also discussed by both the JNAP (2010) and SNC (2012) such as coral bleaching and declining quantity and quality of water resources As discussed by Nurse et al. (2014) the impacts of climate change are distinguished between observed impacts and projected impacts, although the differences are not yet well identified by literature on small islands.

This research discovered that the knowledge of climate change impacts in Tongatapu is varied among the participants, according to their magnitude, frequency, temporal and spatial extent and the bio-physical nature of the island and its social, economic and political setting. This view is applicable to Tongatapu, the low-lying coastal areas such as Kanokupolu and Nukuleka have experienced sea level rise at a high magnitude. Discussing the impacts of climate change with the inhabitants of these areas, their focus was mainly on sea level rise and water salinization. Participants from other locations considered impacts such as poor crop productivity more seriously. These perceptions are largely based on the magnitude and frequency with which they are affected by the events.

6.3. Who constructs climate change knowledge in Tonga?

Literature based on climate change in Tonga is limited, therefore, this research predominantly relied on the JNAP (2010) and SNC (2012) reports in order to identify what has been done to produce knowledge about the issue and how this knowledge is being distributed.

6.3.1. Power and knowledge

This research reveals that the Ministry of Environment and Climate Change, and the National Executive Agency for climate change activities have the power to distribute knowledge on this issue. Cannon and Müller-Mahn (2010) observe that since global warming is caused by human action, then climate change is socially constructed in a material sense. Discursively, knowledge of climate change is inconsistent amongst the participants; they were lacking the understanding of the science of the issue and almost ten per cent of the participants were proved to have very limited knowledge about this issue. What has been discovered here is that the CCA & DRM national joint team and their consultation programmes are not effective enough to distribute the information effectively. Because these consultations are focused only on vulnerable communities, participants from three of the villages observed there were no visits from the DECC to their various settings, and therefore their understanding of the issue is quite limited. However, it is difficult to predict the outcome of these programmes. There is hardly any literature discussing the exact outcome of these programmes, such as, for example how many people attended meetings and what were the people's responses to these programmes.

McCarthy (1996) stresses that significance of considering individual's observation and reasons. This is because each individual has got an absolute right to participate in the process of governance.

6.3.2. Media dissemination

The role played by the media in promulgating climate change knowledge can be both revealing and misleading. Bostrom (2003) asserts that the media will have to communicate climate change in appropriate words and effective images. Lowe *et*

al. (2006) also believe that the representations of climate change such as those in the media do impact the way the public perceive climate change basically because it can create behavioural patterns. The establishment of the JNAP (2010) is very constructive in terms of providing adaptation and mitigation measures. On the other hand, ninety per cent of the participants are not aware of this report at all. The majority of the participants gain their knowledge mainly from watching programmes on television and listening to the radio. However, the findings revealed that there is some misleading information that may affect people's understanding. Some participants associated tsunami with climate change. In some interviews, the interviewees are seemingly captured by the image of tsunami events. They significantly named 'evacuation route' to be an adaptation option for climate change. This corresponded with what Barnett and Campbell (2010) sought to highlight. They emphasized the point that the media dissemination and language deployed by the 'insiders' (for instance, the MECC in Tonga) can be sometimes misleading and cause fear instead of absorbing relevant information about the issue. They stressed that it is important to build public understanding of climate change as it allows the people in the community to choose and implement relevant adaptive options to climate change.

6.3.3. Trusted messengers

As discussed earlier in this section, the MECC had established a national joint team to engage people with consultation programmes. Having interviewed three town officers, their response to climate change were constructive. They are from vulnerable communities of Tongatapu. Their knowledge of the issue was developed from the training programmes that they periodically attended. They also pointed out that the consultation programmes running in their various villages are not always successful because there are only small numbers of locals who attend. This feedback prompted the discussion to explore what they believed to be the most effective way to distribute information about the issue to the whole village community. The participants' responses concur with Moser and Dilling (2004), who suggest that distributing climate change information to the people will more be efficient if it is done by trusted messengers. Lowe et al. (2006) support this by saying that the source of information and who is giving it out is

paramount to the public. This literature is relevant to the findings. Church leaders were identified by the participants to be the most powerful people to give the information on climate change. This is correlated to their status in the communities. As noted, the people of Tonga are marked by their religious beliefs and their full commitment to Christianity. They consider the church obligations are very important and they look up to the church ministers. The suggestion that was given is for the church ministers to be educated first with the relevant information about climate change, so they can then distribute it to the rest of the community. Women's groups were also named as effective to deliver the information. This suggestion was based on the status of females at home and in the community, that they are constructive and their ability to work as a team will empower the rest of the family and the village to understand climate change.

The Tonga SNC (2012) report outlines information on training and awareness programmes organized by the MECC to engage the people of the country with knowledge of how to adapt to the effect of climate change. The communication and awareness programmes involved school visits, drama competitions, coastal tree planting competitions, youth parliaments, women's conferences and climate change awareness materials such as posters, brochures and TV spots. What this research has established is that Tonga has been equipped with substantial resources and programmes to ensure proper and effective adaptation of climate change. The JNAP (2010), for example, indicated that Tonga is progressing well regarding climate change. This projection is based on the SNC 2012) report and JNAP (2010). Applying this information to the findings based on what the participants have said, only some information was taken on board and some understandings of climate change were contradictory. However, as discussed earlier, because the impacts of climate change varied from place to place in Tongatapu, the adaptation measures developed were also different among villages. Barnett and Campbell (2010) discuss how funding is essential in terms of adaptation. It was clearly shown from this research that many communities in Tongatapu are only relying on financial support from the government and overseas donors. Different literatures discuss the limited adaptation and mitigation measures available in the Pacific due to factors such as socio-economic and geographical characteristics. Mataki et al. (2008) name some basic factors that

may hinder adaptation in the Pacific such as weak governance and institutional frameworks, weak socio-economic conditions and lack of technical capacity. The JNAP report (2010) shows their attempt to establish governance and an institutional framework but to establish whether it is effective or not, extra research will need to be conducted. But as mentioned before, some views from the participants are not consistent with what is in these reports. To start with, majority of the participants are not aware of the JNAP report. This is consistent with Hay and Mimura (2010), who point out that a smart effort is required at all levels to address climate change. Therefore, it is pertinent to ensure that the constructive information in JNAP is communicated to all levels including those at the grass roots: as highlighted by Barnett and Campbell (2010), climate change discussions will be more successful if they are designed at the level of the villages since adaptation measures can only be understood in terms of the social context in which the adaptation takes place.

The strong communal nature of living and working together of the Pacific island people is regarded by Mataki et al. (2008) as unique. The UNESCO (2013) also discuss how traditional knowledge used to be a powerful coping mechanisms in Pacific island communities. Traditional support systems in Pacific island communities are one of the effective mechanisms for resilience: social cohesion, networks and cooperation. The organisations of events such as traditional feasts and ceremonies provided opportunities for cooperation within and among communities and islands. This view concurs with Kelman (2007), presenting the aspects of kinship networks, unique heritage and local knowledge to deal with environmental changes including climate change. With strong social networks and cooperation of the local people, the people of Kanokupolu constructed their own sea wall and planted coastal vegetation on their own; different fundraising activities were held to accomplish this project and it was successful. For some other villages, this system of cooperation was lacking.

All in all, the research revealed that climate change knowledge and practices in Tonga are socially constructed. Tonga accepted the Kyoto Protocol in 2008 and had joined mitigation actions to contribute to the objective of the UNFCCC and encouraged the using of Renewable Energy Resources. This is identified by Haas

(2004) as a dialogue between power and knowledge in which understanding of climate change has been socially constructed. The research has unveiled hidden meanings of climate change utilised by the people of Tongatapu and this concurs with Pettenger (2007), who believes that exploring how climate change is recognised, conceptualised and constructed in different contexts is important as it may bring to light the hidden meaning lost in the field of climate change.

Berger and Luckmann (1967) who were among early originators of the idea of social construction, see people defining reality in their everyday life and how they obtain and use knowledge to manage their own behaviour. Therefore these views were supported by different writers, and bring to light the notion that individuals are already embodied in a social structure, therefore the social context of individuals frames their values, attitudes and worldviews. Applying this approach to the findings of this research, I discovered that the knowledge of the participants about climate change is significantly influenced and shaped by their individual social settings.

CHAPTER SEVEN: CONCLUSION

7.1. Local knowledge versus scientific knowledge

The existing local knowledge of the participants is profoundly important as it gives a clear indication of where the people are placed in the facet of climate change awareness. This research has revealed that the social setting of the participants influenced their capacity of understanding the issue and also their ability to cope with the impacts of climate change. The group of participants with the explicit knowledge about climate change were mainly professionals; and their considerable education background allowed them access to more scientific aspects of climate change. Education is divulged as a powerful mechanism to enrich people's knowledge about climate change. Local knowledge is occasionally left unnoticed by those who are disseminating the science of climate change such as the government agencies and climate change policy makers. It was clear from this finding that the majority of the people in the community level are those who obtained this knowledge and very lacking in scientific knowledge.

7.2. Power distribution

The top-down and bottom up approaches were also examined in this research to unearth how the people of Tongatapu think of the present advocate of climate change especially by the responsible stakeholders. The participants were asked to comment on what have been established by the government particularly the MECC to address the impact of climate change. Some of the participants based their answer on the information that is formulated by the MECC on the media such as television and radio. They were quite happy with those programmes and they appreciated the great effort made by the MECC. The unhappy participants were mainly the residents of the climate change-prone villages. The visitations from the MECC to these vulnerable sites were considered satisfactory by some participants but their main concern was to do with the funding from donors and how it is being distributed. These participants were hurt, frustrated, and distressed by the lack of consideration from the MECC in terms of money.

7.3. Confusion

There is a manifest confusion explored in this research. The term '*feliuiuaki 'oe 'ea'* imposed some participants an inaccurate interpretation of the term relative to the definition provided by the IPCC and the UNFCCC. In addition, some participants mistakenly believed tsunami to one impact of climate change. This is due to the lack of clarification made on the programmes disseminated by the media to the public. The differences between climate change and other natural hazards were not identified well by some of the participants.

The primary objective of this research was to examine the people of Tongatapu and their understanding of climate change. The three key questions were utilized in this finding to compass the existing knowledge of these participants. The climate change knowledge and how it was constructed was also paramount in this research. The thesis would not be complete without the following recommendations and suggestions that are based on the findings of this research.

In conclusion, Tonga is exposed to many of the impacts of climate change, some of which are already being experienced. Many local people are concerned about the issue although there is also considerable confusion. It is anticipated that climate change effects will increase in the future and it is critical that public capacity to cope with these impacts is enhanced.

7.4. Recommendations

7.4.1. Power of education

Education is a key way to empower the people at the community level with the necessary knowledge of climate change. This research highlights the participants' lack of appropriate knowledge about this issue. A sufficient level knowledge should be distributed to all levels including the primary school level to the village community level. The adaptive capacity of the people in the community will be successfully enhanced with substantial knowledge of the issue.

7.4.2. Integration of local and scientific knowledge

This research highlights the importance of existing local knowledge of the community members. The development of national policies should integrate existing local knowledge of the people together with the scientific knowledge so in enhancing adaptive capacity. Traditional knowledge systems as they are highlighted in this thesis, can be a possible coping mechanism to address the impacts of climate change. The feedback from the community members that is outlined in this thesis is worth considering as pathways to improving national policies.

7.5. Suggestion for further research

I would recommend further research to be carried out in terms of public awareness of climate change. It will be more effective if the research is specifically based on certain aspects of climate change such as adaptation measures in Tonga and how effective they are. It is also reasonable to carry out research on what funding that Tonga has received from overseas donors annually and how this money is being distributed among the stakeholders including the community. Another research project should be conducted on traditional knowledge in Tonga and its value which may be effective in terms of adaptation and mitigation options. That would reflect ideas on how local knowledge can be integrated with scientific knowledge for a better understanding of this issue.

REFERENCES

Adler, P. and Adler, P. 1994: Observational techniques. In Denzin, N. and Lincoln, Y., editors, *Handbook of Qualitative Research*. London: Sage.

Asian Development Bank 2010: Climate Change in the Pacific: Stepping Up Responses in the Face of Rising Impacts from http://www.adb.org/publications/climate-change-pacific-stepping-responses-face-rising-impacts

Bäckstrand, K. and Lövbrand, E. 2006: Planting trees to mitigate climate change: Contested discourses of ecological modernization, green governmentality and civic environmentalism. *Global Environmental Politics* 6(1), 50-75.

Barnes, T. 2009: Social construction. In Gregory, D., Johnston, R., Pratt, G., Watts, M.J. and Whatmore, S., editors, *The dictionary of human geography* (5th ed.). Chichester, United Kingdom: Wiley-Blackwell, 690-691.

Barnett, J. and Campbell, J.R. 2010: *Climate change and small island states: Power, knowledge, and the South Pacific*. London, United Kingdom: Earthscan.

Berger, P.L. and Luckmann, T. 1967: *The social construction of reality: a treatise in the sociology of knowledge*. London: Penguin.

Bonner, A. and Tolhurst, G. 2002: Insider-outsider perspectives of participant observation. *Nurse researcher* 9(4), 7.

Bostrom, A. 2003: Future risk communication. *Futures* 35(6), 553-573.

Bostrom, A., Granger Morgan, M., Fischoff, B. and Read, D. 1994: What do people know about climage change? Retrieved 18.02.2014 from http://sds.hss.cmu.edu/risk/articles/WhatDoPeopleKnowGClimChgPart1.pdf

Burr, V. 1995: *An introduction to social constructionism*. London; New York: Routledge.

Burr, V. 2003: *Social constructionism* (2nd ed.). London, United Kingdom: Routledge.

Cameron, J. 2005: Focusing on the focus group. In Hay, I., editor, *Qualitative research methods in human geography*. Australia: Oxford University Press, 116-132.

Campbell, I.C. 1992: *Island kingdom : Tonga, ancient & modern*. Christchurch, N.Z.: Canterbury University Press.

Campbell, J.R. 2014: Climate-change migration in the pacific. *The Contemporary Pacific* 26(1), 1-28.

Campbell, J.R. and de Wet, N. 1999 (b): *Adapting to the effects of climate change in the context of development: considerations for pacific island countries: Background report for preparation of a set of guidelines for policy makers and development planners in the Pacific Island Countries.* Hamilton, New Zealand, University of Waikato from

Cannon, T. and Müller-Mahn, D. 2010: Vulnerability, resilience and development discourses in context of climate change. *Natural Hazards* 55(3), 621-635.

Castree, N. 2005: *Nature*. London: Routledge.

Demeritt, D. 1996: Social theory and the reconstruction of science and geography. *Transactions of the Institute of British Geographers* 21(3), 484-503.

Demeritt, D. 2001: The construction of global warming and the politics of science. *Annals of the Association of American Geographers* 91(2), 307-337.

Douglas, M. and Wildavsky, A.B. 1982: *Risk and culture: an essay on the selection of technological and environmental dangers*. Berkeley, CA: University of California Press.

Dunn, K. 2005: Interviewing. In Hay, I., editor, *Qualitative research methods in human geography*. Australia: Oxford University Press, 77-105.

Ellen, R.F. 1982: *Environment, subsistence, and system : the ecology of small-scale social formations*. Cambridge, Cambridgeshire; New York: Cambridge University Press.

Gergen, K.J. 1985: The social constructionist movement in modern psychology. *American Psychologist* 40(3), 266-275.

Gregory, D., Johnston, R., Pratt, G., Watts, M.J. and Whatmore, S., editors 2009: *The dictionary of human geography*. Chichester, United Kingdom: Wiley-Blackwell.

Haas, P. 2004: When does power listen to truth? A constructivist approach to the policy process. *Journal of European Public Policy* 11(4), 569-592.

Halapua, S. 2012: Indigenous Knowledge. Waves of Change: Climate Change in the Pacific Islands and Implications for Hawai'i International Conference, April 4-6, The Center for Pacific Island Studies,. Retrieved 12.11.2013 from http://olelo.granicus.com/MediaPlayer.php?view_id=30&clip_id=34874

Hau'ofa, E. 2008: *We are the ocean: selected works*. Honolulu. University of Hawaii Press from

Hay, J.E., editor 1991: *South Pacific environments: interactions with weather and climate*. Auckland, N.Z.: Environmental Science, University of Auckland.

Hay, J.E. and Institute of international Global Change 2001: *Small islands and the IPCC* (Vol. 2001). Hamilton, N.Z: International Global Change Institute.

Hay, J.E. and Mimura, N. 2010: The changing nature of extreme weather and climate events: risks to sustainable development. *Geomat Nat Hazards Risk* 1(1), 1-16.

Hay, J.E. and Mimura, N. 2013: Vulnerability, Risk and Adaptation Assessment Methods in the Pacific Islands Region: past approaches, and considerations for the future. *Sustain Sci* 8, 391-405.

Hay, J.E. and Sem, G. 2000: *Vulnerability & adaptation: evaluation and regional synthesis of national assessments of vulnerability and adaption to climate change ... report*. Apia, Samoa: South Pacific Regional Environment Programme.

Hulme, M. 2007: Understanding climate change – the power and the limit of science. *Weather* 62(9), 243-244.

Hulme, M. 2013: *Exploring climate change in science and society: an anthology of Mike Hulme's writings, speeches and interviews*. Florence, KY: Routledge.

IPCC 2001: *Climate Change 2001: Synthesis Report. Summary for Policy Makers*. Intergovernmental Panel on Climate Change, Geneva from

IPCC 2007a: *Climate change 2007: impacts, adaptation and vulnerability: contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. New York: Cambridge University Press.

IPCC 2007b: Summary for policymakers. In: Climate change 2007: impacts, adaptation and vulnerability. . In Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E., editors, *Contribution of working group II to the fourth assessment report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, 7-22.

Kalavite, T. 2014: Exploring Pacific-Tongan research approaches. In Fairburn-Dunlop, P. and Coxon, E., editors, *Talanoa: Building a Pasifika Research culture*. New Zealand: Dunmore Publishing Ltd., 159-177.

Kelman, I. 2007: The island advantage: Practices for prospering in isolation. id21 insights 70. Retrieved 25.10.2013 from http://www.id21.org/insights/insights70/index.html

Kelman, I. and Khan, S. 2013: Progressive climate change and disasters: island perspectives. *Natural Hazards* 69(1), 1131-1136.

Kelman, I. and West, J.I. 2009: Climate Change and Small Island Developing States. *Ecological and Environmental Anthropology* 5(1), 1-16.

Kempf, W. 2008: A Sea of Environmental Refugees? Oceania in an Age of Climate Change. Retrieved 19.10.2013 from https://www.google.co.nz/#q=A+Sea+of+Environmental+Refugees%3F+Oceania+in+an+Age+of+Climate+Change

Krueger, R.A. and Casey, M. 2000: *Focus Groups: A practical guide for appplied research* (3rd ed.). California: Sage Publications Inc.

Lane, R. and McNaught, R. 2009: Building gendered approaches to adaptation in the Pacific, Gender and Development. *Climate changes and climate justice* 17(1), 67-80.

Lock, A. and Strong, T. 2010: *Social Constructionism: Sources and stirrings in theory and practice*. Cambridge, GBR: Cambridge University.

Longhurst, R. 2010: Semi-structured interviews and focus groups. In Clifford, N., French, S. and Valentine, G., editors, *Key methods in Geography*. London: Sage Publications Ltd., 103-115.

Lowe, T., Brown, K., Dessai, S., de França Doria, M., Haynes, K. and Vincent, K. 2006: Does tomorrow ever come? Disaster narrative and public perceptions of climate change. *Public Understanding of Science* 15(4), 435-457.

Māhina, O. 1993: The poetics of Tongan traditional history, "Tala-ē-fonua": an ecology-centred concept of culture and history. *The Journal of Pacific History* 28(1), 109-121.

Mannheim, K., Wirth, L. and Shils, E. 1936: *Ideology and utopia: an introduction to the sociology of knowledge*. New York: K. Paul, Trench, Trubner & co.

Mataki, M., Koshy, K. and Nair, V. 2008: Top-down, bottom-up: Mainstreaming adaptation in Pacific island townships. In Leary, N., Adejuwon, J., Barros, V., Burton, I., Kulkarni, J. and Lasco, R., editors, *Climate change and adaptation*. London; Sterling, Va.: Earthscan, 264-278.

Matthews, B. and Ross, L. 2010: *Research methods: A practical guide for the social sciences*. England: Pearson Education Limited.

McCarthy, E.D. 1996: *Knowledge as culture : the new sociology of knowledge*. London ; New York: Routledge.

Mimura, N., Nurse, L., McLean, R., Agard, J., Briguglio, L., Lefale, P., Payet, R. and Sem, G. 2007: Small Islands. In Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E., editors, *Climate change 2007: impacts, adaptation and vulnerability : contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. New York: Cambridge University Press, 687-716.

Ministry of Environment and Climate Change (MECC) 2005: Initial national communication. Retrieved 2/11.2013 from http://unfccc.int/resource/docs/natc/tonnc1.pdf

Ministry of Environment and Climate Change (MECC) 2012: Tonga's Second National Communication on Climate Change. Retrieved 28.08.2013 from http://unfccc.int/resource/docs/natc/tonnc2.pdf

Ministry of Environment and Climate Change (MECC) and National Emergency Management Office (NEMO), T. 2010: *Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management 2010–2015*. Nuku'alofa, Tonga. Kingdom of Tonga from

Morrison, S.L., Vaioleti, T.M. and Veramu, J. 2002: *Participatory approaches to learning and training*. Commissioned report for the European commission, Soqosoqo in Vakamarama, Nabua, Fiji from

Nakalevu, T. 2006: *A Guide to Community Vulnerability and Adaptation Assessment and Action*. Apia: Secretariat of the PaciFIc Regional Environment Programme from

Nelkin, D. 1987: *Selling science: how the press covers science and technology*. New York: W.H. Freeman.

Nunn, P. 2009: Responding to the challenges of climate change in the Pacific Islands: management and technological imperatives. *Clim Res* 40, 211-231.

Nunn, P.D. 1997: *Keimami sa vakila na liga ni Kalou = Feeling the hand of God : human and nonhuman impacts on Pacific island environments* (3rd ed.). Suva, Fiji: School of Social and Economic Development, The University of the South Pacific.

Nurse, L., McLean, R., Agard, J., Briguglio, L.P., Duvat, V., Pelesikoti, N., Tompkins, E. and Webb, A. 2014: *IPCC WGII AR5 Chapter 29* from

O'Leary, Z. 2007: Social constructionism. *The Social Science Jargon-Buster* (Sage UK.

Pelling, M. and Uitto, J.I. 2001: Small island developing states: natural disaster vulnerability and global change. *Environmental Hazards* 3(2), 49-62.

Pettenger, M.E. 2007: *The social construction of climate change: power, knowledge, norms, discourses*. Aldershot, England: Ashgate.

Pulu, T.B. 2013: Climate-Change Blues: Sustaining Village Life in Tonga. *The e-Journal on Indigenous Pacific Issues* 6(1), 260-305.

Ray, C. 2002: Cultural paradigms and challenges. In Spray, S.L. and McGlothlin, K.L., editors, *Global climate change*. Lanham, MD: Rowman & Littlefield, 81-100.

Rippl, S. 2002: Cultural theory and risk perception: a proposal for a better measurement. *Journal of Risk Research* 5(2), 147-165.

Royle, S.A. 2001: *A geography of islands: small island insularity*. London; New York: Routledge.

Seacrest, S., Kuzelka, R. and Leonard, R. 2000: Global climate change and public perception: The challenge of translation. *JAWRA Journal of the American Water Resources Association* 36(2), 253-263.

Shaw, R., Pulhin, J.M. and Pereira, J.J. 2010: *Climate change adaptation and disaster risk reduction* (Vol. 4; 4). Bingley, UK: Emerald.

Smith, N. and O'Keefe, P. 1980: Geography, Marx and the concept of nature. *Antipode* 12(2), 30-39.

Tanskanen, M. 2009: Nature, History of. In Kitchin, R. and Thrift, N., editors, *International Encyclopedia of Human Geography*. Oxford: Elsevier, 293-297.

Television Tonga News 2013: Television Tonga News in English, Tonga Broadcasting Commission. Retrieved 15.02.2014 from http://www.youtube.com/watch?v=U6yUmaIFW6I

Thaman, K. 2010: Teacher capacities for working towards peace and sustainable development. *International Journal of sustainability in higher education* 11(4), 353-364.

Thaman, K. 2011: The kakala framwork. Retrieved 7.3.2014 from http://akoaotearoa.ac.nz/project/pasifika-learners-and-success-tertiary-education-blogs/kakala-framwork-prof-konai-thaman

Tonga Department of Statistics 2013: Tonga statistics at a Glance. Retrieved 15.05.2014 from http://www.spc.int/prism/tonga/

UNESCO 2013: Traditional knowledge for adapting to climate change: Safeguarding intangible cultural heritage. Retrieved 10.03.2014 from http://unesdoc.unesco.org/images/0022/002253/225313e.pdf

United Nations 1992: United Nations Framework Convention on Climate Change from http://unfccc.int/resource/docs/convkp/conveng.pdf

Unluer, S. 2012: Being an insider researcher while conducting case study research. *The Qualitative Report* 17(29), 1.

Vaioleti, T.M. 2006: Talanoa research methodology: a developing position on pacific research. *Waikato Journal of Education* 12, 21-34.

Wahlberg, A.A.F. and Sjoberg, L. 2000: Risk perception and the media. *Journal of Risk Research* 3(1), 31-50.

Weingart, P. and Pansegrau, P. 2003: Introduction: Perception and Representation of Science in Literature and Fiction Film. *Public Understanding of Science* 12(3), 227-228.

White, L., Jr. 1967: The historical roots of our ecologic crisis. *Science* 155(3767), 1203-1207.

Wilson, F. and Tagg, S. 2010: Social constructionism and personal constructivism. *International Journal of Gender and Entrepreneurship* 2(1), 68-82.

Wratt, D.S., New Zealand Meteorological, S., New Zealand Climate Change, P. and New Zealand. Ministry for the, E. 1991: *Climate change: the consensus and the debate*. Wellington, N.Z. New Zealand Meteorological Service. 9780477058575; 0477058574 from